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Coastal and Hydraulics Laboratory

US Army Corps
of Engineers®
Engineer Research and
Development Center

# Physical Model Test for Bendway Weir Design Criteria

Waterway Simulation Technology, Inc.

October 2002

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# Physical Model Test for Bendway Weir Design Criteria

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Final report

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Washington, DC 20314-1000

Monitored by Coastal and Hydraulics Laboratory
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Vicksburg, MS 39180-6199

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# Preface

The work described herein summarizes the results for physical model testing of bendway weir design criteria including conditions and design options needed for a model testing plan for determining navigation impacts.

The report was written and prepared by Waterway Simulation Technology, Inc., 2791 Burnt House Road, Vicksburg, MS. The work was monitored by the Inland Navigation Group, Coastal and Hydraulics Laboratory (CHL), U.S. Army Engineer Research and Development Center (ERDC), Vicksburg, MS, during the period June 1998 to September 2002. It was completed under Contract No. DACW 39-99-P-0443 in support of Research Work Unit No. 32256: Effects of Bendway Weirs on Navigation, No. 333, Inland Navigation.

Project Manager was Ms. Sandra Knight, Technical Director and former Chief, Navigation Branch, CHL. Principal Investigators were Mr. Don Wilson, Chief, Navigation Branch, CHL, and Mr. Michael Winkler, CHL. Other lab members involved were Mr. Keith Green and Ms. Peggy Van Norman, both of CHL.

During publication of this report, Dr. James R. Houston was Director of ERDC, and COL John W. Morris III, EN, was Commander and Executive Director.

# Conversion Factors, Non-SI to SI Units of Measurement

Non-SI units of measurement used in this report can be converted to SI units as follows:

| Multiply | By | To Obtain |
|---|---|---|
| cubic feet | 0.02831685 | cubic meters |
| feet | 0.3048 | meters |

# 1 Introduction

## Background

During the last decade the U.S. Army Corps of Engineers has been placing structures called bendway weirs (submerged dikes) in river bends to improve stability of navigation channels and, consequently, reduce dredging. In some cases these weirs have improved navigation conditions, especially when physical models have been tested prior to construction to determine efficacy of the designs. However, for many constructed bendway weir systems either no model testing was performed or effects on tow navigation were not considered in their design. In one project physical model test, Montgomery Point Lock and Dam, some designs were tested which were shown by the model to create dangerous conditions for navigation, particularly for upbound tows. Some anecdotal stories from tow pilots concerning a few in-place weir systems have been received which claim difficult navigation conditions at various river stages. Some similar situations have been reported for submerged dike fields in lock approaches.

## Study Approach

A multi-faceted approach was used to determine the range of conditions and various design options that need to be included in a model testing plan for determining navigation impacts of bendway weirs. A critical part of the effort was to identify all of the existing bendway and lock approach weir systems which have either been constructed or designed and awaiting construction. Furthermore, information concerning each of the weir systems was critical including design specifications, pre- and post-construction bottom surveys and navigation history, and flow conditions. Two U.S. Army Engineer Districts, Vicksburg and St. Louis, have designed and constructed bendway weir systems. These offices provided design materials such as as-built drawings, hydrographic surveys and flow histories for defining weir conditions. All the bendway weir systems investigated were located on the Mississippi River.

The plans, histories and designs were analyzed and categorized to define ranges of design parameters and conditions experienced at the weir systems since construction. Also, data bases were examined for these areas to identify accidents near the weir fields and conditions at the time. Questionnaires were sent to towing companies and their pilots to document incidents and opinions concerning pre- and post-construction navigation difficulties near the constructed weir fields. The companies contacted included American Commercial Barge Line, Ingram Towing, Brownwater Towing, and Midland.

# 2 Design

## Existing Bendway Weir Project Design Method

Most of the bendway weir projects (95%) have been built in and were designed by the St. Louis District. Two of these projects were modeled, Dogtooth Bend at river mile 22 and Price's Landing at river mile 30. Dogtooth Bend was modeled both with physical and mathematical modeling and was monitored with extensive prototype measurements as the project developed through the years, including following the 1993 flood.

Since these first two projects, the other bendway weir projects have been designed with the following procedure:

- Photos of ice flows in the river are obtained and the flow patterns examined through the bend.
- Using the flow patterns of the ice in combination with the overall bend plan form, the general flow pattern would be drawn in the through the project bend.
- Based on bathymetry, the number of weirs that could physically be built would be determined. At least -25 LWRP is needed for developing a minimum 10 feet[1] structure section.
- All weirs were generally laid out at an angle 30 degrees to a line drawn perpendicular to flow (as drawn from the ice photo). However, about 3 years into implementation, the angle of the last weirs was changed to bring flow into the crossing more in alignment with the channel. The last weir was place either perpendicular or slightly angled upstream into the flow.
- All weirs were built to a -15 LWRP.

Generally these projects were designed to reduce the maintenance requirements and develop a wider channel by forcing the point bar away from the outside bank of the bend. The redirection of the flow using the submerged weirs to erode the point bar also generally improved the navigation conditions by

[1] A table of factors for converting non-SI units of measurement to SI units is presented on page vi.

creating a more evenly distributed flow field. However, each weir field is unique and the development of the channel was dependent on the bed and bank conditions as well as the flow field. Some weir fields contain underlying rock strata, clay, and other non-erodible material that give a different bed response.

## Data Analysis

For each weir system hydrographic survey sheets were used to identify certain design specifications. Hard-copies of the survey sheets were used to measure channel width and bend angles and to choose locations for tangents on the outside of each of the bends. Additionally, most of the weir systems had high resolution dredging survey data in CAD format which allowed close inspection of bottom contour details. For standardization, the bends were assumed to be circular and the tangent coordinates were used to calculate chord distances and bend radii. Because of the engineering judgment required for these measurements, the bend parameters identified in this report for the weir systems are approximate and should serve only as nominal values.

To establish a comparative measure of the effect of weir construction on the river bottom elevation, pre- and post-construction surveys were examined for minimum elevations immediately downstream of each of the weirs (or proposed weirs for the pre-surveys). Minimum elevations chosen from the CAD survey drawings were based on engineering judgment and represent approximate values for the purpose of before and after comparison. Weir height presented in this report is the vertical distance between two locations, one being the deepest point just downstream of the weir and the other being the top of the weir. To determine the orientation of the weirs with the upstream direction, a circular arc with the calculated radius was graphically placed over the dredging contour drawings and the angle formed at the intersection of the arc and each weir was measured. The distance between weirs was the length of a line from the end of the weir on the outside of the bend to the perpendicular intersection with the next weir downstream.

According to St. Louis District engineers all the weirs constructed in the middle Mississippi River have a top elevation of –15 ft below Low Water Reference Plane (LWRP). The weirs designed and constructed in the Vicksburg District had a weir-top elevation of –20 ft LWRP. Using these values and historical river stage records from gauging stations along the applicable reaches, the range of water depth over the weirs was calculated. Data from the gauging stations between River Mile (RM) 196 and RM 2 on the middle Mississippi and the gauging station at Arkansas City on the lower Mississippi were used to determine these depths. The $10^{th}$ and $90^{th}$ percentile, average, and minimum and maximum water depth over the weirs were calculated using the cumulative distribution from the river stage records and interpolating to the bendway weir system locations (for the Middle Mississippi). At Victoria Bend on the Lower Mississippi the stage record at Arkansas City was used to calculate water depth, after adjustment for the correct LWRP elevation at the weirs.

To document opinion of the navigation impacts of weir construction questionnaires were sent to tow pilots from several towing companies. The pilots were asked to give ratings to four questions aimed at determining whether tow navigation had been improved or degraded following construction of individual weir systems. Furthermore, anecdotal comments and opinions were elicited from the pilots to help identify navigational problem areas. Table 1 shows the questions asked and tabulates average ratings received from the pilots for most of the bendway weir systems. Pilot comments are included in the following section.

For this study seventeen weir systems constructed on the Middle Mississippi were investigated and one on the Lower Mississippi. Two weir systems on the Lower Mississippi are currently being designed; however, proposals for these systems were not final during the present study and little definitive information was available for the purpose of investigating navigation impacts. Details of each of the bendway weir systems are discussed below, including pilot comments directed at the specific location. Table 2 is compendium of design specifications for all the constructed weir systems.

**TABLE 1 - Pilot Average Ratings for Bendway Weirs**

| BEND | Difficulty of Controlling Tow in Bend 1 = Easy 10 = Very Difficult | | | | | | | | Erratic Control Upbound? Post Construction? 1 = Yes 2 = No | | | Flanking Required Downbound? 0 = Never 1 = Sometimes 2 = often 3 = Always | | | | Normal Speed Upbound 1 = 2-3 mph 2 = 4-5 mph 3 = 6-7 mph 4 = 8-10 mph | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Downbound | | | | Upbound | | | | | | | | | | | | | | |
| | High Flow | | Low Flow | | High Flow | | Low Flow | | Flow | | | High Flow | | Low Flow | | High Flow | | Low Flow | |
| | Pre | Post | Pre | Post | Pre | Post | Pre | Post | High | Medium | Low | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| Greenfield | 4.4 | 4.3 | 4.8 | 4.7 | 3.8 | 3.6 | 4.1 | 4.7 | 1.6 | 1.6 | 1.5 | 1.3 | 1.2 | 2.4 | 1.7 | 1.9 | 1.6 | 2.3 | 1.7 |
| Eliza | 2.4 | 2.4 | 2.9 | 2.7 | 2.3 | 2.6 | 2.4 | 2.9 | 2.0 | 2.0 | 1.9 | 0.1 | 0.1 | 0.3 | 0.1 | 1.9 | 1.6 | 2.0 | 1.8 |
| Scudders | 4.3 | 3.4 | 5.0 | 3.9 | 3.3 | 3.4 | 3.9 | 4.3 | 1.7 | 1.6 | 1.6 | 1.1 | 0.7 | 1.8 | 1.3 | 1.6 | 1.8 | 2.0 | 1.9 |
| Dogtooth | 4.5 | 4.4 | 5.4 | 4.9 | 3.5 | 3.6 | 4.2 | 4.5 | 1.5 | 1.4 | 1.4 | 1.0 | 0.5 | 1.6 | 1.1 | 1.7 | 1.4 | 1.8 | 1.6 |
| Price's Landing | 4.2 | 3.8 | 4.7 | 4.1 | 3.8 | 3.5 | 4.0 | 3.1 | 1.9 | 1.8 | 1.8 | 0.7 | 0.4 | 1.2 | 0.7 | 1.9 | 1.8 | 1.8 | 1.8 |
| Cape Bend | 3.5 | 3.4 | 3.9 | 3.7 | 2.9 | 2.7 | 3.7 | 3.1 | 1.9 | 1.9 | 1.9 | 0.7 | 0.3 | 1.3 | 0.8 | 1.9 | 1.8 | 1.8 | 1.9 |
| Cape Rock | 4.1 | 4.3 | 4.7 | 4.6 | 3.6 | 3.3 | 4.1 | 3.7 | 1.6 | 1.5 | 1.5 | 0.8 | 0.5 | 1.6 | 0.8 | 1.7 | 1.8 | 1.8 | 1.9 |
| Picayune | 3.0 | 2.9 | 3.4 | 3.0 | 2.8 | 2.7 | 3.1 | 2.3 | 2.0 | 1.9 | 1.9 | 0.0 | 0.0 | 0.1 | 0.0 | 2.0 | 1.8 | 2.0 | 1.9 |
| Fountain Bluff | 4.2 | 4.2 | 4.6 | 4.6 | 3.4 | 3.3 | 4.1 | 3.8 | 1.6 | 1.5 | 1.6 | 0.9 | 0.6 | 1.7 | 0.9 | 1.8 | 1.7 | 1.7 | 1.8 |
| Red Rock | 4.8 | 3.2 | 6.1 | 4.0 | 4.3 | 3.1 | 4.8 | 3.2 | 1.8 | 1.7 | 1.7 | 1.0 | 0.7 | 1.9 | 1.0 | 2.0 | 1.8 | 1.8 | 1.9 |
| Kaskaskias | 4.2 | 3.8 | 4.8 | 4.4 | 3.5 | 3.4 | 3.8 | 3.3 | 1.9 | 1.9 | 1.8 | 0.9 | 0.5 | 1.6 | 0.9 | 2.0 | 1.8 | 1.8 | 1.8 |
| St. Genevieve | 4.2 | 3.7 | 4.4 | 3.8 | 3.3 | 3.3 | 3.4 | 2.6 | 1.8 | 1.8 | 1.7 | 0.2 | 0.0 | 0.6 | 0.1 | 2.1 | 1.8 | 2.0 | 1.9 |
| Ft. Chartres | 3.9 | 3.5 | 4.5 | 4.4 | 3.2 | 3.4 | 3.8 | 4.3 | 1.6 | 1.5 | 1.4 | 0.9 | 0.6 | 1.8 | 1.0 | 1.9 | 1.8 | 1.8 | 1.6 |
| Carl Baer | 3.3 | 2.9 | 3.8 | 3.1 | 3.1 | 2.8 | 3.4 | 2.3 | 1.9 | 1.9 | 1.8 | 0.1 | 0.1 | 0.1 | 0.1 | 2.1 | 1.9 | 2.1 | 1.9 |
| Bellarive | 2.5 | 2.1 | 3.1 | 2.2 | 2.2 | 2.2 | 2.6 | 2.2 | 1.8 | 1.8 | 1.8 | 0.1 | 0.1 | 0.2 | 0.1 | 1.8 | 1.8 | 1.8 | 2.0 |
| Mosenthein | 5.4 | 4.8 | 5.4 | 5.4 | 3.8 | 3.6 | 3.9 | 3.7 | 1.6 | 1.6 | 1.6 | 0.1 | 0.1 | 0.1 | 0.1 | 1.3 | 1.4 | 1.7 | 1.6 |
| Victoria | 4.6 | 5.0 | 5.6 | 6.2 | 4.4 | 4.2 | 5.2 | 5.9 | 1.5 | 1.4 | 1.2 | 1.3 | 1.2 | 2.4 | 2.0 | 1.6 | 1.5 | 1.7 | 1.5 |

| BEND | Improvement | | | | | | | | Improvement | | Improvement | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Downbound | | | | Upbound | | | | | | | |
| | High Flow | | Low Flow | | High Flow | | Low Flow | | High Flow | | High Flow | |
| Greenfield | 0.1 | | 0.1 | | 0.2 | | -0.6 | | 0.1 | 0.8 | -0.3 | -0.6 |
| Eliza | 0.0 | | 0.3 | | -0.3 | | -0.5 | | 0.0 | 0.2 | -0.4 | -0.2 |
| Scudders | 0.9 | | 1.1 | | 0.0 | | -0.4 | | 0.5 | 0.5 | 0.2 | -0.1 |
| Dogtooth | 0.2 | | 0.5 | | -0.1 | | -0.2 | | 0.5 | 0.4 | -0.4 | -0.2 |
| Price's Landing | 0.4 | | 0.6 | | 0.3 | | 0.9 | | 0.3 | 0.5 | -0.1 | 0.0 |
| Cape Bend | 0.0 | | 0.3 | | 0.3 | | 0.6 | | 0.4 | 0.5 | -0.1 | 0.1 |
| Cape Rock | -0.2 | | 0.1 | | 0.3 | | 0.4 | | 0.2 | 0.8 | 0.1 | 0.1 |
| Picayune | 0.1 | | 0.4 | | 0.1 | | 0.7 | | 0.0 | 0.1 | -0.2 | -0.1 |
| Fountain Bluff | 0.0 | | 0.0 | | 0.2 | | 0.3 | | 0.3 | 0.8 | -0.1 | 0.1 |
| Red Rock | 1.6 | | 2.1 | | 1.1 | | 1.6 | | 0.3 | 0.9 | -0.2 | 0.1 |
| Kaskaskias | 0.4 | | 0.4 | | 0.2 | | 0.4 | | 0.5 | 0.6 | -0.2 | 0.0 |
| St. Genevieve | 0.5 | | 0.6 | | 0.0 | | 0.8 | | 0.2 | 0.5 | -0.2 | -0.1 |
| Ft. Chartres | 0.4 | | 0.1 | | -0.2 | | -0.6 | | 0.3 | 0.8 | -0.1 | -0.2 |
| Carl Baer | 0.4 | | 0.8 | | 0.3 | | 1.1 | | 0.0 | 0.0 | -0.3 | -0.2 |
| Bellerive | 0.4 | | 0.9 | | 0.1 | | 0.5 | | 0.0 | 0.1 | 0.0 | 0.2 |
| Mosenthein | 0.5 | | 0.0 | | 0.2 | | 0.2 | | 0.0 | 0.0 | 0.1 | -0.1 |
| Victoria | 0.4 | | -0.6 | | 0.3 | | -0.7 | | 0.1 | 0.5 | 0.0 | -0.2 |

**TABLE 2 - Bendway Weir Characteristics**

| Project | | | Bend Angle (Degrees) | Bend Radius (Ft) | Min Channel Width (Ft) -10 ft Contour | Water Depth Over Weir (ft) 90th Percentile | Avg | 10th Percentile | Max | Min | Weir No. | Length (Ft) | Dist. To Next Weir (Ft | Weir Angle (Deg) | Pre-Construction Max Depth (Ft) (Below LWRP) | Pre-Construction Weir Height (Ft) | Post-Construction Max Depth (Ft) (Below LWRP) | Post-Construction Weir Height (Ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Greenfield Bend | River: | Miss. | 71 | 4600 | 340 | 52.2 | 37.2 | 27.5 | 66.3 | 20.5 | 1 | 817 | 663 | 69 | 35.8 | 20.8 | 31.8 | 16.8 |
| | Date Completed | Oct-95 | | | | | | | | | 2 | 677 | 568 | 60 | 36.8 | 21.8 | 16.8 | 1.8 |
| | Project Extent (River Miles) | 3.1 - 3.9 | | | | | | | | | 3 | 780 | 716 | 68 | 38.8 | 23.8 | 16.8 | 1.8 |
| | LWRP (NGVD) | 278.8 | | | | | | | | | 4 | 756 | 753 | 76 | 44.8 | 29.8 | 39.8 | 24.8 |
| | Nav. Problems Reported | Yes | | | | | | | | | 5 | 696 | 797 | 72 | 38.8 | 23.8 | 64.8 | 49.8 |
| | Weir Top Elevation | 263.8 | | | | | | | | | 6 | 551 | 743 | 71 | 37.8 | 22.8 | 59.8 | 44.8 |
| | | | | | | | | | | | 7 | 576 | | 64 | 40.8 | 25.8 | 22.8 | 7.8 |
| Eliza Point | River: | Miss. | 53 | 5300 | 900 | 52.0 | 36.9 | 27.3 | 65.9 | 20.3 | 1 | 559 | 947 | 61 | 37.5 | 22.5 | 25.5 | 10.5 |
| | Date Completed | Dec-95 | | | | | | | | | 2 | 529 | 350 | 72 | 39.5 | 24.5 | 37.5 | 22.5 |
| | Project Extent (River Miles) | 5.7 - 6.7 | | | | | | | | | 3 | 597 | 570 | 77 | 53.5 | 38.5 | 45.5 | 30.5 |
| | LWRP (NGVD) | 280.5 | | | | | | | | | 4 | 755 | 600 | 70 | 37.5 | 22.5 | 35.5 | 20.5 |
| | Nav. Problems Reported | No | | | | | | | | | 5 | 724 | 657 | 67 | 58.5 | 43.5 | 28.5 | 13.5 |
| | Weir Top Elevation | 265.5 | | | | | | | | | 6 | 530 | 890 | 66 | 51.5 | 36.5 | 46.5 | 31.5 |
| | | | | | | | | | | | 7 | 533 | 357 | 65 | 37.5 | 22.5 | 26.5 | 11.5 |
| | | | | | | | | | | | 8 | 533 | | 66 | 35.5 | 20.5 | 18.5 | 3.5 |
| Scudder's | River: | Miss. | 76 | 7500 | 900 | 51.3 | 36.3 | 26.9 | 64.9 | 20.1 | 1 | 439 | 295 | 60 | 29.9 | 14.9 | Not Available | |
| | Date Completed | Dec-95 | | | | | | | | | 2 | 435 | 368 | 63 | 27.9 | 12.9 | | |
| | Project Extent (River Miles) | 16.7 - 17.3 | | | | | | | | | 3 | 584 | 352 | 55 | 54.9 | 39.9 | | |
| | LWRP (NGVD) | 286.9 | | | | | | | | | 4 | 450 | 276 | 50 | 49.9 | 34.9 | | |
| | Nav. Problems Reported | No | | | | | | | | | 5 | 445 | 266 | 42 | 68.9 | 53.9 | | |
| | Weir Top Elevation | 271.9 | | | | | | | | | 6 | 447 | 274 | 42 | 63.9 | 48.9 | | |
| | | | | | | | | | | | 7 | 446 | 338 | 45 | 54.9 | 39.9 | | |
| | | | | | | | | | | | 8 | 485 | 421 | 42 | 43.9 | 28.9 | | |
| | | | | | | | | | | | 9 | 552 | 430 | 51 | 30.9 | 15.9 | | |
| | | | | | | | | | | | 10 | 550 | | 55 | 32.9 | 17.9 | | |
| Dogtooth Bend | River: | Miss | 108 | 6400 | 520 | 50.8 | 35.9 | 26.6 | 64.2 | 20.0 | 1 | 641 | 1252 | 57 | Not Available | | 20.7 | 5.7 |
| | Date Completed | Dec-90 | | | | | | | | | 2 | 559 | 1487 | 59 | | | 35.7 | 20.7 |
| | Project Extent (River Miles) | 22.4 - 24.2 | | | | | | | | | 3 | 555 | 1507 | 75 | | | 49.7 | 34.7 |
| | LWRP (NGVD) | 290.7 | | | | | | | | | 4 | 967 | 687 | 70 | | | 51.7 | 36.7 |
| | Nav. Problems Reported | No | | | | | | | | | 5 | 912 | 728 | 66 | | | 69.7 | 54.7 |
| | Weir Top Elevation | 275.7 | | | | | | | | | 6 | 966 | 509 | 60 | | | 50.7 | 35.7 |
| | | | | | | | | | | | 7 | 745 | 732 | 64 | | | 44.7 | 29.7 |
| | | | | | | | | | | | 8 | 783 | 667 | 58 | | | 57.7 | 42.7 |
| | | | | | | | | | | | 9 | 593 | 656 | 61 | | | 42.7 | 27.7 |
| | | | | | | | | | | | 10 | 721 | 586 | 68 | | | 36.7 | 21.7 |
| | | | | | | | | | | | 11 | 664 | 609 | 61 | | | 34.7 | 19.7 |
| | | | | | | | | | | | 12 | 748 | 1355 | 64 | | | 26.7 | 11.7 |
| | | | | | | | | | | | 13 | 709 | | 70 | | | 24.7 | 9.7 |
| Price's Landing | River: | Miss | 68 | 5500 | 620 | 51.1 | 36.2 | 27.0 | 64.2 | 20.6 | 1 | 1077 | 440 | 54 | 39.0 | 24.0 | 31.0 | 16.0 |
| | Date Completed | Nov-91 | | | | | | | | | 2 | 1103 | 676 | 54 | 45.0 | 30.0 | 52.0 | 37.0 |
| | Project Extent (River Miles) | 29.6 - 30.6 | | | | | | | | | 3 | 1216 | 416 | 59 | 49.0 | 34.0 | 26.0 | 11.0 |
| | LWRP (NGVD) | 294 | | | | | | | | | 4 | 1086 | 638 | 67 | 33.0 | 18.0 | 23.0 | 8.0 |
| | Nav. Problems Reported | No | | | | | | | | | 5 | 1063 | 628 | 64 | 43.0 | 28.0 | 45.0 | 30.0 |
| | Weir Top Elevation | 279 | | | | | | | | | 6 | 1116 | 583 | 52 | 47.0 | 32.0 | 58.0 | 43.0 |
| | | | | | | | | | | | 7 | 843 | 648 | 58 | 50.0 | 35.0 | 56.0 | 41.0 |
| | | | | | | | | | | | 8 | 885 | 833 | 53 | 52.0 | 37.0 | 28.0 | 13.0 |
| | | | | | | | | | | | 9 | 915 | | 58 | 40.0 | 25.0 | 32.0 | 17.0 |

(Continued)

**TABLE 2 - (Continued)**

| Project | | | Bend Angle (Degrees) | Bend Radius (Ft) | Min Channel Width (Ft) -10 ft Contour | Water Depth Over Weir (ft) 90th Percentile | Avg | 10th Percentile | Max | Min | Weir No. | Length (Ft) | Dist. To Next Weir (Ft | Weir Angle (Deg) | Pre-Construction Max Depth (Ft) (Below LWRP) | Pre-Construction Weir Height (Ft) | Post-Construction Max Depth (Ft) (Below LWRP) | Post-Construction Weir Height (Ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cape Bend | | | 107 | 7600 | 640 | 47.0 | 32.3 | 23.5 | 59.5 | 17.4 | 1 | 457 | 429 | 55 | 30.0 | 15.0 | 26.0 | 11.0 |
| | River: | Miss | | | | | | | | | 2 | 409 | 459 | 53 | 39.0 | 24.0 | 28.0 | 13.0 |
| | Date Completed | Mar-95 | | | | | | | | | 3 | 332 | 531 | 56 | 30.0 | 15.0 | 28.0 | 13.0 |
| | Project Extent (River Miles) | 48.3 - 49.5 | | | | | | | | | 4 | 398 | 446 | 56 | 30.0 | 15.0 | 40.0 | 25.0 |
| | LWRP (NGVD) | 308 | | | | | | | | | 5 | 442 | 440 | 60 | 30.0 | 15.0 | 22.0 | 7.0 |
| | Nav. Problems Reported | No | | | | | | | | | 6 | 467 | 571 | 63 | 34.0 | 19.0 | 24.0 | 9.0 |
| | Weir Top Elevation | 293 | | | | | | | | | 7 | 481 | 616 | 62 | 36.0 | 21.0 | 23.0 | 8.0 |
| | | | | | | | | | | | 8 | 556 | 659 | 64 | 30.0 | 15.0 | 24.0 | 9.0 |
| | | | | | | | | | | | 9 | 541 | 546 | 67 | 28.0 | 13.0 | 23.0 | 8.0 |
| | | | | | | | | | | | 10 | 478 | 721 | 67 | 25.0 | 10.0 | 15.0 | 0.0 |
| | | | | | | | | | | | 11 | 343 | 593 | 67 | 21.0 | 6.0 | 19.0 | 4.0 |
| | | | | | | | | | | | 12 | 432 | 604 | 61 | 22.0 | 7.0 | 19.0 | 4.0 |
| | | | | | | | | | | | 13 | 425 | | 64 | 22.0 | 7.0 | 25.0 | 10.0 |
| Cape Rock (Upper) | | | 81 | 4600 | 740 | 46.8 | 32.1 | 23.5 | 59.2 | 17.4 | 1 | 535 | 349 | 71 | 24.5 | 9.5 | 46.5 | 33.5 |
| | River: | Miss | | | | | | | | | 2 | 559 | 451 | 67 | 29.5 | 14.5 | 37.5 | 22.5 |
| | Date Completed | Feb-92 | | | | | | | | | 3 | 641 | 401 | 75 | 24.5 | 9.5 | 37.5 | 22.5 |
| | Project Extent (River Miles) | 54.6 - 54.9 | | | | | | | | | 4 | 543 | | 81 | 24.5 | 9.5 | 29.5 | 14.5 |
| | LWRP (NGVD) | 311.5 | | | | | | | | | | | | | | | | |
| | Nav. Problems Reported | No | | | | | | | | | | | | | | | | |
| | Weir Top Elevation | 296.5 | | | | | | | | | | | | | | | | |
| Cape Rock (Lower) | | | 47 | 6300 | 800 | 46.8 | 32.1 | 23.5 | 59.2 | 17.4 | 1 | 559 | 400 | 101 | 19.1 | 4.1 | 42.1 | 27.1 |
| | Date Completed | Feb-92 | | | | | | | | | 2 | 782 | 422 | 101 | 24.1 | 9.1 | 53.1 | 38.1 |
| | Project Extent (River Miles) | 53.8 - 54.1 | | | | | | | | | 3 | 1036 | 463 | 104 | 19.1 | 4.1 | 50.1 | 35.1 |
| | LWRP (NGVD) | 311.1 | | | | | | | | | 4 | 1161 | | 106 | 24.1 | 9.1 | 51.1 | 36.1 |
| | Nav. Problems Reported | No | | | | | | | | | | | | | | | | |
| | Weir Top Elevation | 296.1 | | | | | | | | | | | | | | | | |
| Picayune | | | 78 | 10500 | 720 | 46.4 | 31.8 | 23.2 | 58.7 | 17.2 | 1 | 329 | 647 | 57 | 25.7 | 10.7 | 33.7 | 18.7 |
| | River: | Miss | | | | | | | | | 2 | 296 | 620 | 64 | 22.7 | 7.7 | 33.7 | 18.7 |
| | Date Completed | Feb-95 | | | | | | | | | 3 | 409 | 771 | 51 | 31.7 | 16.7 | 38.7 | 23.7 |
| | Project Extent (River Miles) | 55.8 - 57.8 | | | | | | | | | 4 | 442 | 665 | 57 | 44.7 | 29.7 | 46.7 | 31.7 |
| | LWRP (NGVD) | 312.7 | | | | | | | | | 5 | 568 | 580 | 63 | 39.7 | 24.7 | 39.7 | 24.7 |
| | Nav. Problems Reported | No | | | | | | | | | 6 | 726 | 654 | 61 | 43.7 | 28.7 | 53.7 | 38.7 |
| | Weir Top Elevation | 297.7 | | | | | | | | | 7 | 683 | 628 | 59 | 35.7 | 20.7 | 33.7 | 18.7 |
| | | | | | | | | | | | 8 | 724 | 616 | 59 | 35.7 | 20.7 | 33.7 | 18.7 |
| | | | | | | | | | | | 9 | 602 | 675 | 59 | 39.7 | 24.7 | 33.7 | 18.7 |
| | | | | | | | | | | | 10 | 718 | 665 | 65 | 31.7 | 16.7 | 46.7 | 31.7 |
| | | | | | | | | | | | 11 | 447 | 564 | 66 | 28.7 | 13.7 | 23.7 | 8.7 |
| | | | | | | | | | | | 12 | 613 | 590 | 62 | 28.7 | 13.7 | 24.7 | 9.7 |
| | | | | | | | | | | | 13 | 839 | 649 | 66 | 32.7 | 17.7 | 24.7 | 9.7 |
| | | | | | | | | | | | 14 | 611 | | 63 | 26.7 | 11.7 | 28.7 | 13.7 |
| Fountain Bluff | | | 98 | 6400 | 700 | 47.3 | 32.8 | 24.8 | 58.7 | 19.3 | 1 | 742 | 586 | 61 | 34.0 | 19.0 | 29.0 | 14.0 |
| | River: | Miss | | | | | | | | | 2 | 567 | 550 | 61 | 37.0 | 22.0 | 56.0 | 41.0 |
| | Date Completed | Jan-96 | | | | | | | | | 3 | 666 | 517 | 67 | 42.0 | 27.0 | 29.0 | 14.0 |
| | Project Extent (River Miles) | 83.0 - 84.1 | | | | | | | | | 4 | 680 | 679 | 69 | 33.0 | 18.0 | 31.0 | 16.0 |
| | LWRP (NGVD) | 326 | | | | | | | | | 5 | 424 | 582 | 69 | 53.0 | 38.0 | 38.0 | 23.0 |
| | Nav. Problems Reported | No | | | | | | | | | 6 | 465 | 436 | 66 | 52.0 | 37.0 | 53.0 | 38.0 |
| | Weir Top Elevation | 311 | | | | | | | | | 7 | 420 | 651 | 68 | 50.0 | 35.0 | 53.0 | 38.0 |
| | | | | | | | | | | | 8 | 690 | 551 | 62 | 41.0 | 26.0 | 40.0 | 25.0 |
| | | | | | | | | | | | 9 | 661 | 742 | 71 | 43.0 | 28.0 | 55.0 | 40.0 |
| | | | | | | | | | | | 10 | 916 | | 57 | 38.0 | 23.0 | 61.0 | 46.0 |

(Continued)

TABLE 2 - (Continued)

| Project | | | Bend Angle (Degrees) | Bend Radius (Ft) | Min Channel Width (Ft) -10 ft Contour | Water Depth Over Weir (ft) 90th Percentile | Avg | 10th Percentile | Max | Min | Weir No. | Length (Ft) | Dist. To Next Weir (Ft | Weir Angle (Deg) | Pre-Construction Max Depth (Ft) (Below LWRP) | Weir Height (Ft) | Post-Construction Max Depth (Ft) (Below LWRP) | Weir Height (Ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Red Rock | River: | Miss | 88 | 3800 | 840 | 47.9 | 33.5 | 25.7 | 59.0 | 20.4 | 1 | 994 | 713 | 66 | 24.0 | 9.0 | 21.0 | 6.0 |
| | Date Completed | Jan-93 | | | | | | | | | 2 | 709 | 683 | 67 | 39.0 | 24.0 | 34.0 | 19.0 |
| | Project Extent (River Miles) | 93.7 - 94.8 | | | | | | | | | 3 | 636 | 472 | 70 | 39.0 | 24.0 | 62.0 | 47.0 |
| | LWRP (NGVD) | 331 | | | | | | | | | 4 | 1020 | 540 | 67 | 39.0 | 24.0 | 65.0 | 50.0 |
| | Nav. Problems Reported | No | | | | | | | | | 5 | 1166 | 674 | 63 | 34.0 | 19.0 | 64.0 | 49.0 |
| | Weir Top Elevation | 316 | | | | | | | | | 6 | 1085 | 591 | 70 | 39.0 | 24.0 | 42.0 | 27.0 |
| | | | | | | | | | | | 7 | 1084 | 820 | 69 | 39.0 | 24.0 | 65.0 | 50.0 |
| | | | | | | | | | | | 8 | 1052 | 732 | 75 | 39.0 | 24.0 | 72.0 | 57.0 |
| | | | | | | | | | | | 9 | 1017 | | 74 | 34.0 | 19.0 | 53.0 | 38.0 |
| Kaskaskia Bend | River: | Miss | 81 | 5500 | 600 | 46.5 | 32.4 | 25.0 | 56.9 | 20.1 | 1 | 658 | 690 | 62 | 36.1 | 21.1 | 30.1 | 15.1 |
| | Date Completed | Mar-94 | | | | | | | | | 2 | 747 | 834 | 58 | 30.1 | 15.1 | 20.1 | 5.1 |
| | Project Extent (River Miles) | 16.0 - 117.1 | | | | | | | | | 3 | 747 | 460 | 65 | 21.1 | 6.1 | 30.1 | 15.1 |
| | LWRP (NGVD) | 344.1 | | | | | | | | | 4 | 555 | 523 | 69 | 24.1 | 9.1 | 24.1 | 9.1 |
| | Nav. Problems Reported | No | | | | | | | | | 5 | 619 | 508 | 55 | 25.1 | 10.1 | 22.1 | 7.1 |
| | Weir Top Elevation | 329.1 | | | | | | | | | 6 | 310 | 352 | 56 | 28.1 | 13.1 | 30.1 | 15.1 |
| | | | | | | | | | | | 7 | 427 | 390 | 51 | 28.1 | 13.1 | 34.1 | 19.1 |
| | | | | | | | | | | | 8 | 515 | 327 | 48 | 31.1 | 16.1 | 20.1 | 5.1 |
| | | | | | | | | | | | 9 | 516 | 438 | 51 | 26.1 | 11.1 | 24.1 | 9.1 |
| | | | | | | | | | | | 10 | 446 | 371 | 51 | 23.1 | 8.1 | 24.1 | 9.1 |
| | | | | | | | | | | | 11 | 659 | | 51 | 26.1 | 11.1 | 23.1 | 8.1 |
| St. Genevieve | River: | Miss | 52 | 10300 | 800 | 48.2 | 32.0 | 24.8 | 58.4 | 19.9 | 1 | 391 | 371 | 56 | 30.4 | 15.4 | Not Available | |
| | Date Completed | Sep-97 | | | | | | | | | 2 | 431 | 445 | 60 | 30.4 | 15.4 | | |
| | Project Extent (River Miles) | 19.8 - 120.8 | | | | | | | | | 3 | 461 | 453 | 57 | 28.4 | 13.4 | | |
| | LWRP (NGVD) | 348.4 | | | | | | | | | 4 | 459 | 445 | 58 | 27.4 | 12.4 | | |
| | Nav. Problems Reported | No | | | | | | | | | 5 | 533 | 625 | 64 | 25.4 | 10.4 | | |
| | Weir Top Elevation | 331.4 | | | | | | | | | 6 | 459 | 574 | 66 | 23.4 | 8.4 | | |
| | | | | | | | | | | | 7 | 435 | 578 | 64 | 32.4 | 17.4 | | |
| | | | | | | | | | | | 8 | 461 | 530 | 64 | 27.4 | 12.4 | | |
| | | | | | | | | | | | 9 | 485 | 722 | 68 | 23.4 | 8.4 | | |
| | | | | | | | | | | | 10 | 504 | | 91 | 25.4 | 10.4 | | |
| Fort Chartes | River: | Miss | 55 | 6000 | 600 | 45.0 | 30.9 | 23.8 | 54.8 | 19.2 | 1 | 564 | 848 | 61 | Not Available | | 47.0 | 32.0 |
| | Date Completed | Apr-94 | | | | | | | | | 2 | 703 | 493 | 70 | | | 28.0 | 13.0 |
| | Project Extent (River Miles) | 29.9 - 131.0 | | | | | | | | | 3 | 720 | 700 | 48 | | | 27.0 | 12.0 |
| | LWRP (NGVD) | 353 | | | | | | | | | 4 | 791 | 618 | 43 | | | 63.0 | 48.0 |
| | Nav. Problems Reported | Yes | | | | | | | | | 5 | 835 | 507 | 58 | | | 37.0 | 22.0 |
| | Weir Top Elevation | 338 | | | | | | | | | 6 | 1068 | 695 | 58 | | | 37.0 | 22.0 |
| | | | | | | | | | | | 7 | 936 | 521 | 58 | | | 16.0 | 1.0 |
| | | | | | | | | | | | 8 | 1420 | 782 | 55 | | | 16.0 | 1.0 |
| | | | | | | | | | | | 9 | 1242 | | 50 | | | 16.0 | 1.0 |
| Establishment | River: | Miss | 34 | 9700 | 940 | 45.0 | 31.0 | 24.0 | 54.8 | 19.4 | 1 | 834 | 395 | 68 | 36.2 | 21.2 | Not Available | |
| | Date Completed | Sep-98 | | | | | | | | | 2 | 920 | 425 | 67 | 49.2 | 34.2 | | |
| | Project Extent (River Miles) | 132.7 - 133 | | | | | | | | | 3 | 736 | 570 | 74 | 42.2 | 27.2 | | |
| | LWRP (NGVD) | 354.2 | | | | | | | | | 4 | 948 | | 67 | 40.2 | 25.2 | | |
| | Nav. Problems Reported | No | | | | | | | | | | | | | | | | |
| | Weir Top Elevation | 339.2 | | | | | | | | | | | | | | | | |

(Continued)

TABLE 2 - (Concluded)

| Project | | | Bend Angle (Degrees) | Bend Radius (Ft) | Min Channel Width (Ft) -10 ft Contour | Water Depth Over Weir (ft) 90th Percentile | Avg | 10th Percentile | Max | Min | Weir No. | Length (Ft) | Dist. To Next Weir (Ft | Weir Angle (Deg) | Pre-Construction Max Depth (Ft) (Below LWRP) | Pre-Construction Weir Height (Ft) | Post-Construction Max Depth (Ft) (Below LWRP) | Post-Construction Weir Height (Ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carl Baer | | | 39 | 8700 | 800 | 45.4 | 31.5 | 25.2 | 54.1 | 21.2 | 1 | 447 | 667 | 61 | 20.1 | 5.1 | 28.1 | 13.1 |
| | River: | Miss | | | | | | | | | 2 | 517 | 379 | 64 | 45.1 | 30.1 | 24.1 | 9.1 |
| | Date Completed | Sep-96 | | | | | | | | | 3 | 523 | 610 | 68 | 25.1 | 10.1 | 26.1 | 11.1 |
| | Project Extent (River Miles) | 63.3 - 164.0 | | | | | | | | | 4 | 655 | 456 | 71 | 45.1 | 30.1 | 27.1 | 12.1 |
| | LWRP (NGVD) | 370.1 | | | | | | | | | 5 | 658 | 498 | 74 | 25.1 | 10.1 | 28.1 | 13.1 |
| | Nav. Problems Reported | No | | | | | | | | | 6 | 752 | | 78 | 35.1 | 20.1 | 22.1 | 7.1 |
| | Weir Top Elevation | 355.1 | | | | | | | | | | | | | | | | |
| Bellerive | | | N/A | Straight | 460 | 46.4 | 32.6 | 26.5 | 54.8 | 22.7 | 1 | 575 | 671 | 56 | 24.7 | 9.7 | 23.7 | 8.7 |
| | River: | Miss | | | | | | | | | 2 | 722 | 680 | 54 | 34.7 | 19.7 | 24.7 | 9.7 |
| | Date Completed | Apr-96 | | | | | | | | | 3 | 760 | 689 | 55 | 24.7 | 9.7 | 24.7 | 9.7 |
| | Project Extent (River Miles) | 74.0 - 174.7 | | | | | | | | | 4 | 840 | 816 | 56 | 24.7 | 9.7 | 26.7 | 11.7 |
| | LWRP (NGVD) | 374.7 | | | | | | | | | 5 | 1055 | | 55 | 24.7 | 9.7 | 29.7 | 14.7 |
| | Nav. Problems Reported | No | | | | | | | | | | | | | | | | |
| | Weir Top Elevation | 359.7 | | | | | | | | | | | | | | | | |
| Mosenthein | | | 33 | 11300 | 1140 | 35.8 | 22.2 | 16.5 | 43.6 | 13.0 | 1 | 871 | 547 | 57 | 43.9 | 28.9 | 43.9 | 28.9 |
| | River: | Miss | | | | | | | | | 2 | 650 | 521 | 68 | 48.9 | 33.9 | 46.9 | 31.9 |
| | Date Completed | Apr-97 | | | | | | | | | 3 | 652 | 625 | 67 | Not Available | | 47.9 | 32.9 |
| | Project Extent (River Miles) | 93.9 - 195.0 | | | | | | | | | 4 | 749 | 2404 | 66 | | | 46.9 | 31.9 |
| | LWRP (NGVD) | 395.9 | | | | | | | | | 5 | 631 | 696 | 59 | | | 58.9 | 43.9 |
| | Nav. Problems Reported | Yes | | | | | | | | | 6 | 788 | | 64 | | | 46.9 | 31.9 |
| | Weir Top Elevation | 380.9 | | | | | | | | | | | | | | | | |
| Victoria Bend | | | 108 | 4200 | 1100 | 52.5 | 37.5 | 25.8 | 63.4 | 21.9 | 1 | 410 | 1074 | 76 | 52.5 | 32.5 | 45.5 | 25.5 |
| | River: | Lower Miss | | | | | | | | | 2 | 390 | 1063 | 71 | 49.5 | 29.5 | 55.5 | 35.5 |
| | Date Completed | 95 | | | | | | | | | 3 | 540 | 1080 | 69 | 54.5 | 34.5 | 75.5 | 55.5 |
| | Project Extent (River Miles) | 594.9 - 595.6 | | | | | | | | | 4 | 660 | 1150 | 69 | 68.5 | 48.5 | 75.5 | 55.5 |
| | LWRP (NGVD) | 112.5 | | | | | | | | | 5 | 681 | 1263 | 75 | 61.5 | 41.5 | 85.5 | 65.5 |
| | Nav. Problems Reported | Yes | | | | | | | | | 6 | 910 | | 73 | 68.5 | 48.5 | 85.5 | 65.5 |
| | Weir Top Elevation | 92.5 | | | | | | | | | | | | | | | | |

# 3 Bendway Weir Field

## Constructed Bendway Weir Systems

**Greenfield Bend**: (Figure 1) Middle Mississippi, RM 3.1 – 3.9, Completed October, 1995, LWRP 278.8 ft above North Gulf Vertical Datum (NGVD)

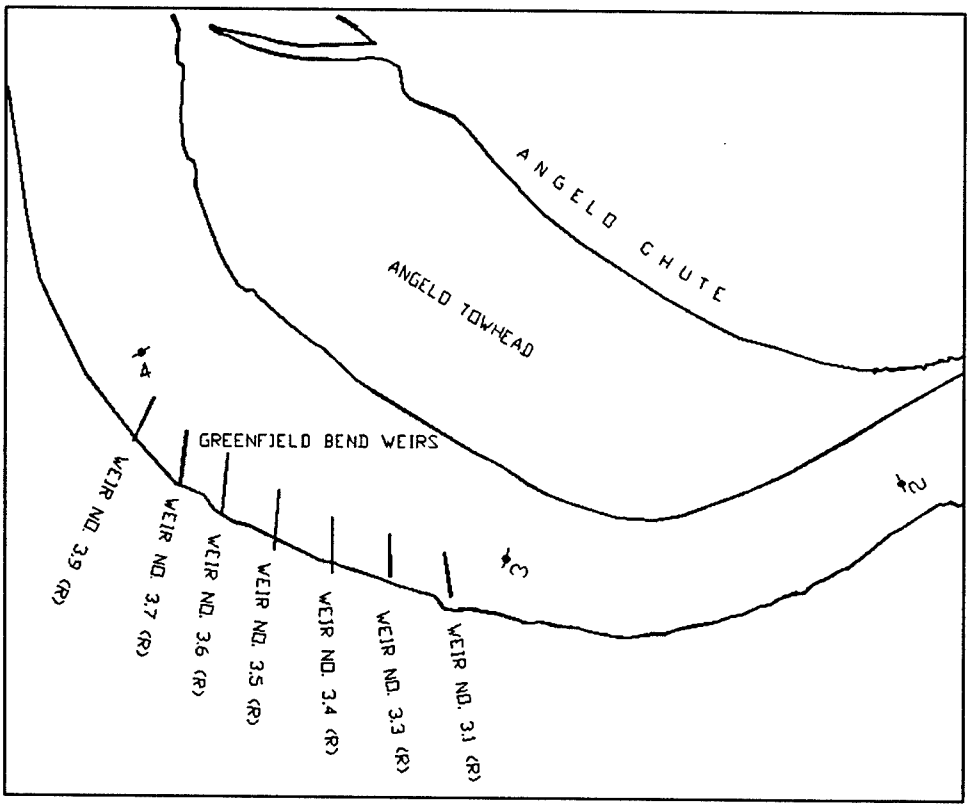


Figure 1. Greenfield Bend

The bend has an approximate angle of 71 degrees and a circular radius of 4600 ft. There are seven bendway weirs in the system with orientation angles of 64 to 76 degrees off the upstream direction. Prior to construction the minimum bottom elevation near the design weir positions ranged from 234 ft to 243 ft NGVD. With the design weir-top elevation of 263.8 ft the weirs were between 20 and 30 ft high immediately after construction. The post-construction survey shows that generally sediment deposition occurred upstream and scour downstream. Based on historical stage records the average depth over the weirs is about 37 ft with a range of 20 ft to 66 ft.

Based on pilot comments, Greenfield Bend was of the more critical areas post-construction. The general comment seemed to be that slow moving tows, i.e., heavy and upbound, tended to be pushed out toward the bar. The average pilot rating for Greenfield after weir construction indicated more difficulty than before in low flow and less difficulty during high flow. The pilot comments were as follows:

- Greenfield, I haven't caught it yet. The only thing I know is my partner told me it turned him every way it could N/B, that was 5/12/98.
- Greenfield Bend is real bad with a slow moving tow. It wants to take you out on the bar at a low flow.
- At Greenfield I noticed a hard draft on red buoy – upbound with a heavy tow barely kept buoy from going under boat. Downbound at Greenfield current was very swift and drafty. I almost overflanked one time out running red buoys and sand bars.
- N/B in low Cairo gage 15 ft or lower, there is a hard draft angle to towhead MI 3.5.

**Eliza Point**: (Figure 2) Middle Mississippi, RM 5.7 – 6.7, Completed December, 1995, LWRP 280.5 ft NGVD.

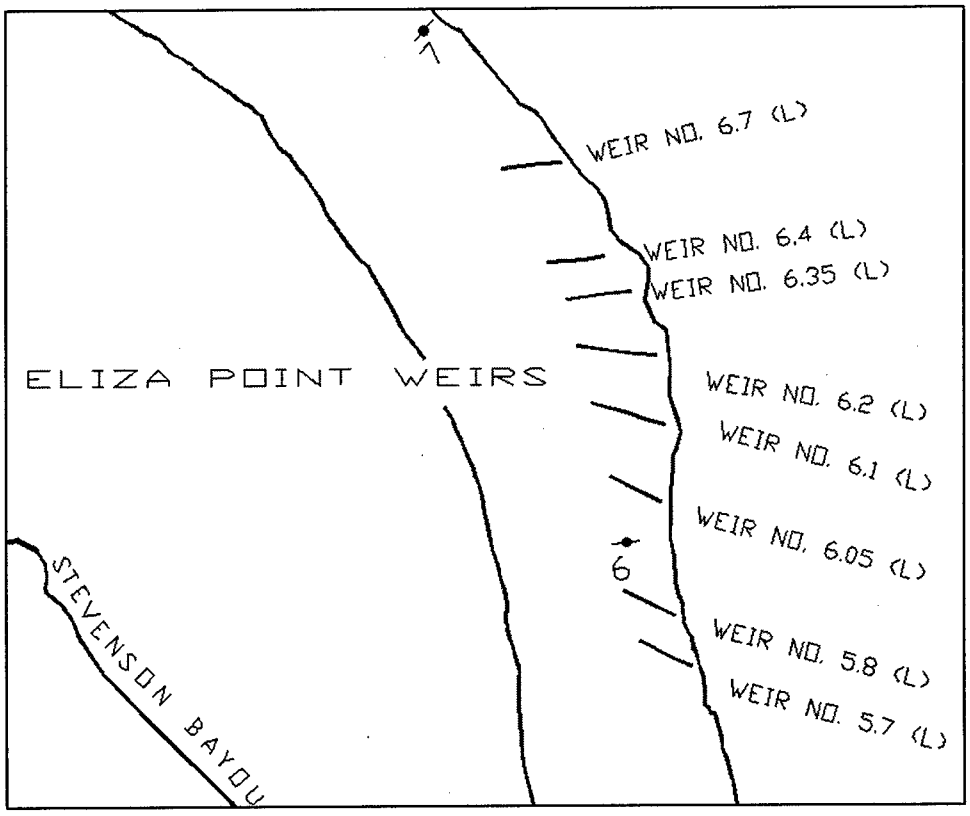


Figure 2. Eliza Point

The bend has an approximate angle of 53 degrees and a circular radius of 5300 ft. There are eight weirs in the system with orientation angles ranging from 61 to 77 degrees from the upstream direction. Prior to construction the minimum bottom elevation near the design weir positions ranged from 222 ft to 245 ft NGVD. With the design weir-top elevation of 265.5 ft the weirs were between 20 and 43 ft high immediately after construction. The post-construction survey shows that generally sediment deposition occurred downstream and scour upstream. The average depth over the weirs is about 37 ft with a range of 20 ft to 66 ft.

The average difficulty rating by the pilots was comparatively low and showed little change post-construction. No comments concerning navigation through Eliza Point bend were received.

**Scudder's Landing** (Figure 3) Middle Mississippi, RM 16.7 – 17.3, Completed December1995, LWRP 286.9 ft NGVD.

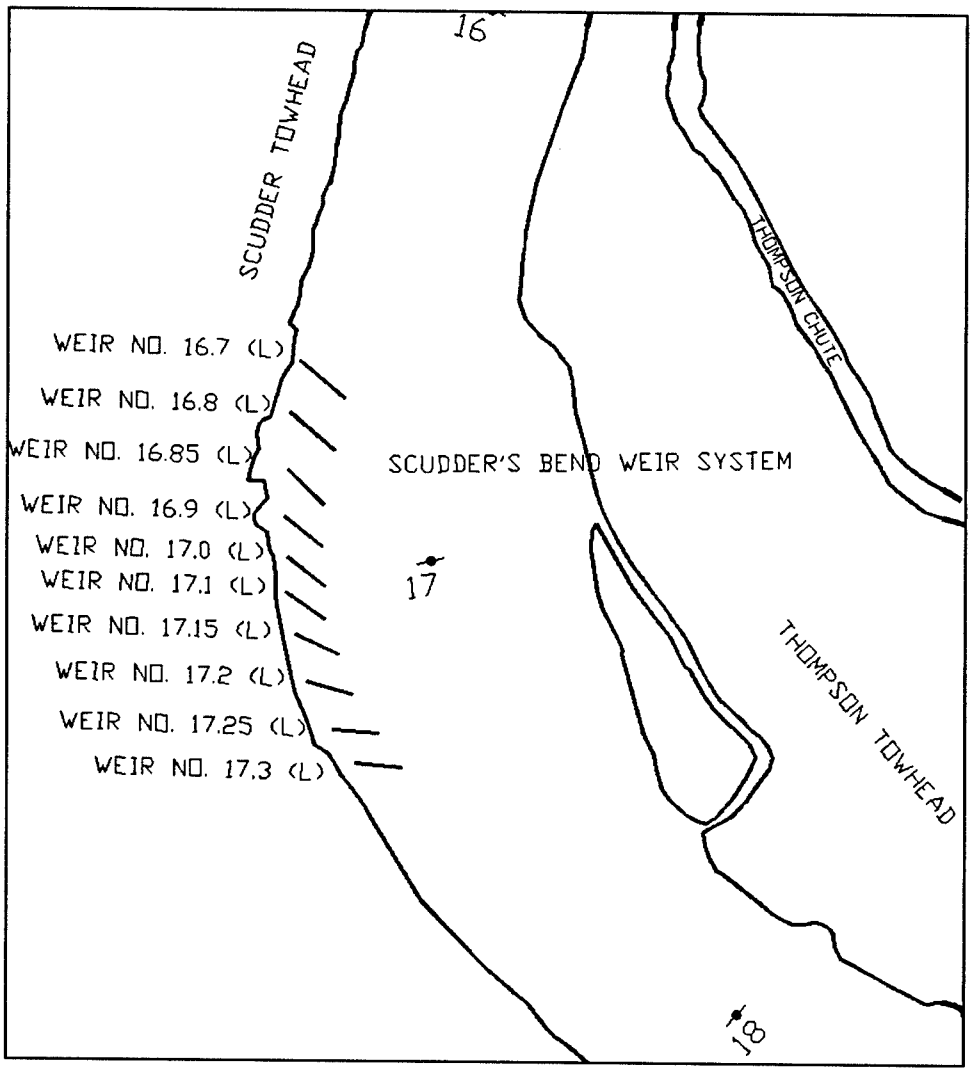


Figure 3. Scudder's Landing

The bend has an approximate angle of 76 degrees and a circular radius of 7500 ft.

There are ten weirs in the system with orientation angles ranging from 42 to 63 degrees from the upstream direction. Prior to construction the minimum bottom elevation near the design weir positions ranged from 218 to 259 ft above NGVD. Since the weir-top elevation was 271.9, the weirs were between 13 and 54 ft high right after construction. No post construction survey was available to determine post construction scour and deposition patterns. The average water depth over the weirs has been about 36 ft with a range of 20 to 65 ft.

Pilot rated difficulty shows post-construction improvement for both high and low flow; however, some disagreement was evident. Pilot comments are as follows:

- Scudders is like Fort Chartres, it grabs the head of the tow and doesn't let go, we have to steer to port to get up through it.
- Cape Rock – Price to Daniels and Scudders are much easier since construction.

**Dogtooth Bend**: (Figure 4) Middle Mississippi, RM 22.4 – 24.2, Completed December 1990, LWRP 290.7 ft NGVD.

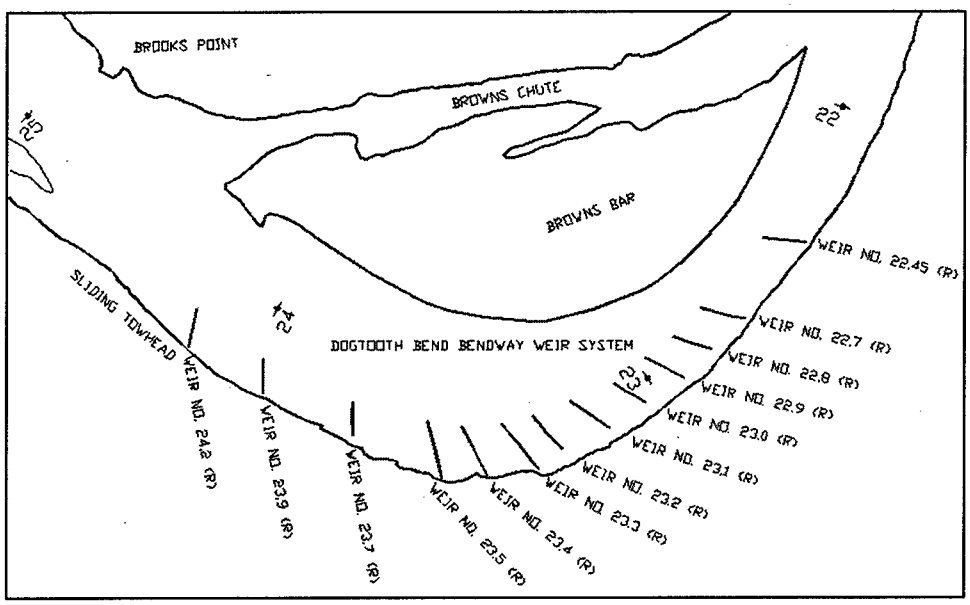


Figure 4. Dogtooth Bend

The bend has an angle of 108 degrees and a circular radius of 6400 ft. There are thirteen weirs in the system with orientation angles ranging from 57 to 75 degrees from the upstream direction. There was no pre-construction survey available; however, the post-construction survey shows that the weir heights ranged from 10 to 55 ft. The average water depth over the weirs was 36 ft and ranged from 21 to 64 ft.

Pilot ratings indicated post-construction improvement in navigation conditions for both high and low flow. Pilot comments were minimal:

- Very strong draft on bar.

**Price's Landing**: (Figure 5) Middle Mississippi, RM 29.6 – 30.6, Completed November 1991, LWRP 294.0 ft NGVD.

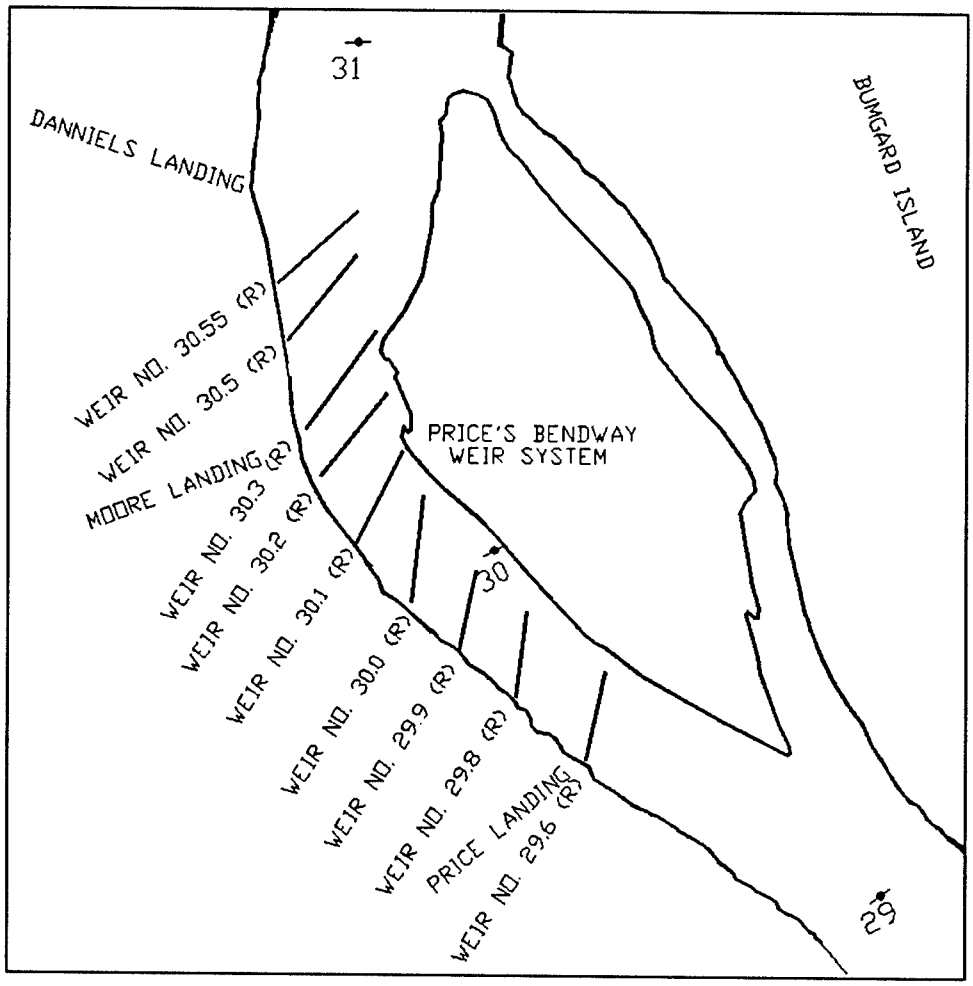


Figure 5. Price's Landing

The bend has an angle of 68 degrees and a circular radius of 5500 ft. There are nine weirs in the system oriented with the upstream direction at angles of 52 to 67 degrees. Prior to construction the minimum bottom elevation near the design weir positions ranged from 242 ft to 261 ft NGVD. With the design weir-top elevation of 279 ft the weirs were between 18 and 37 ft high immediately after construction. The post-construction survey shows that deposition occurred downstream of some of the weirs and scour below others. The average depth over the weirs is about 36 ft with a range of 21 ft to 64 ft.

Pilot ratings show less difficult tow navigation post-construction. Price's Landing was mentioned only once in the pilot comments:

- Cape Bend – Price to Daniels and Scudders are much easier since construction.

**Cape Bend**: (Figure 6) Middle Mississippi, RM 48.3 – 49.5, Completed March 1995, LWRP 308 ft NGVD.

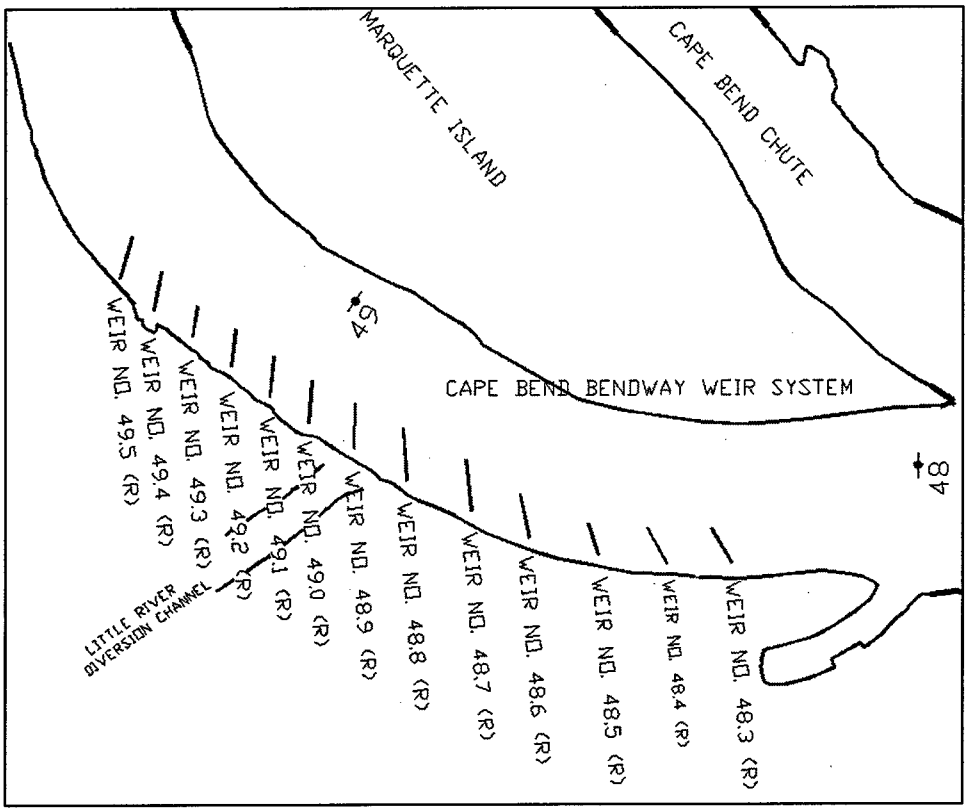


Figure 6. Cape Bend

The bend has an angle of 107 degrees and a circular radius of 7600 ft. There are thirteen weirs in the system oriented with the upstream direction at angles of 53 to 67 degrees. Prior to construction the minimum bottom elevation near the design weir positions ranged from 269 ft to 287 ft NGVD. With the design weir-top elevation of 293 ft the weirs were between 6 and 24 ft high immediately after construction. The post-construction survey shows that generally deposition occurred throughout the weir system. The average depth over the weirs is about 32 ft with a range of 17 ft to 60 ft.

Pilot ratings show less difficult tow navigation post-construction. Cape Bend was mentioned seldom in the pilot comments:

- Cape Bend – Price to Daniels and Scudders are much easier since construction.

- Cape Bend - Sometimes a little disturbance (very good).

**Cape Rock**: (Figure 7) Middle Mississippi, RM 53.8 – 54.9, Completed February 1992, LWRP 311.3

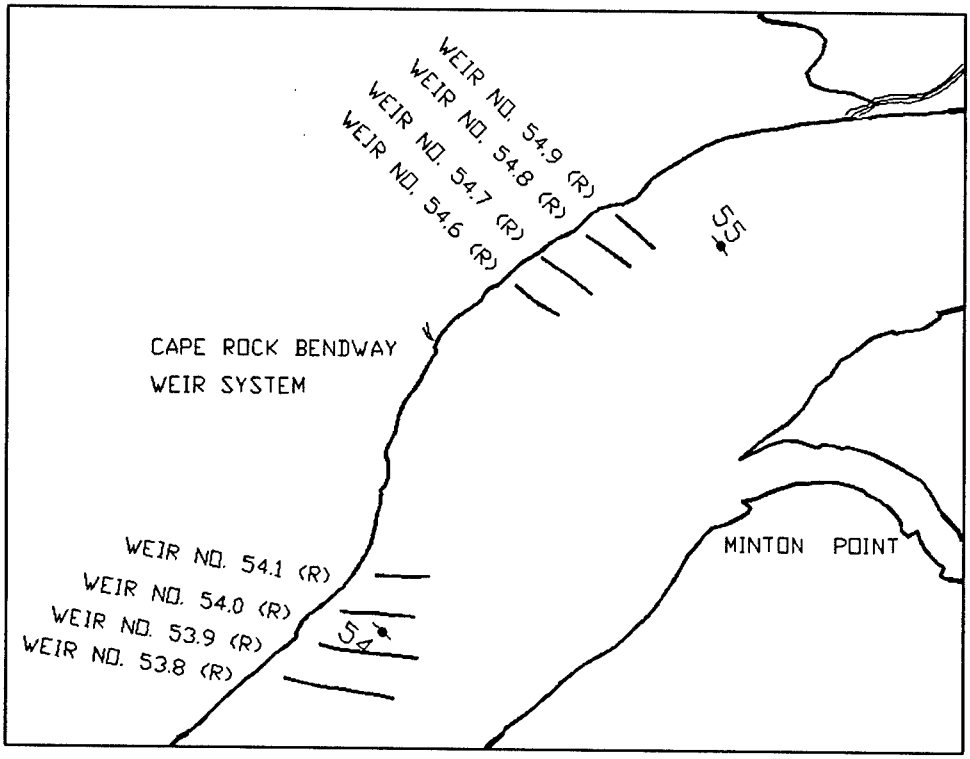


Figure 7. Cape Rock

The weir system is made up of two bends with four weirs in each. The downstream bend has an angle of 47 degrees and the upstream bend is 81 degrees. The circular radii are 6300 and 4600 ft, respectively. The pre-construction minimum bottom elevations ranged from 287 to 292 ft with weir height from 4 ft to 14 ft. The post-construction survey shows deep scour downstream of all the weirs. The average depth over the weirs is about 32 ft with a range of 17 ft to 59 ft.

Pilot ratings indicate an improvement in navigation conditions after construction of the Cape Rock weirs; however, pilot comments conflict:

- Cape Rock still has a large eddy at the foot of the bend and will affect your tow N/B and S/B at most stages.
- Cape Rock – a large eddy at the foot of bend – bad N/B and S/B.
- Cape Rock was real bad for a while but at this time in low flow it seemed somewhat better. That dike below [?} needs to have about half of it removed.

**Picayune** (Figure 8) Middle Mississippi, RM 55.8 – 57.8, Completed February 1995, LWRP 312.7 ft NGVD.

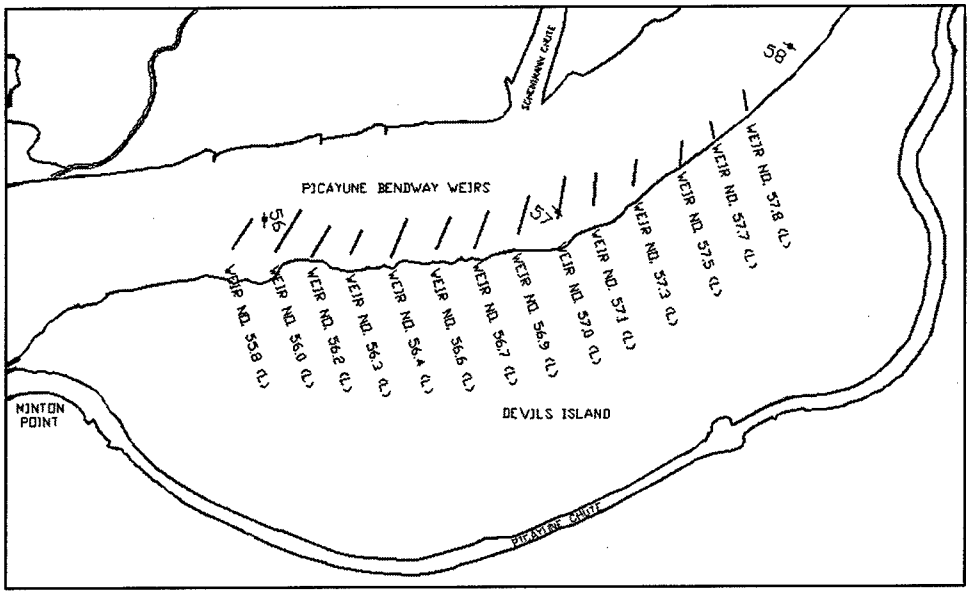


Figure 8. Picayune

The bend angle is approximately 78 degrees with a radius of 10,500 ft. There are fourteen weirs in the system with orientation angles with the upstream direction of 51 to 66 degrees. Minimum pre-construction bottom elevations ranged from 268 ft to 290 ft NGVD giving weir heights between 8 and 30 ft. Post-construction surveys show scour generally upstream and deposition downstream. The average water depth over the weirs is 32 ft with a range of 17 to 59 ft.

Pilot ratings show less difficult tow navigation post-construction. The pilots did not comment specifically on the Picayune Bend.

**Fountain Bluff**: (Figure 9) Middle Mississippi, RM 83 – 84.1, Completed January 1996, LWRP 326 ft NGVD

The bend angle is about 98 degrees with a radius of 6400 ft. There are ten weirs constructed and are oriented with the upstream direction at between 57 and 71 degrees. Minimum pre-construction bottom elevations ranged from 273 ft to 292 ft and the weirs were anywhere from 18 ft to 38 ft high. A post-construction survey showed some deep scour holes but overall not much change in weir height. The average water depth over the weirs is 33 ft ranging from 19 ft to 59 ft.

Pilot ratings show a general improvement in navigation conditions at Fountain Bluff post-construction. Pilot comments suggest that conditions have slowly improved:

- Fountain Bluff was bad during and several months after, but has settled down and smoothed out over the years.
- Fountain Bluff was bad during and several months after, has settled down over the years.

- Fountain Bluff was critical but has settled down now.
- Strong draft on bar.

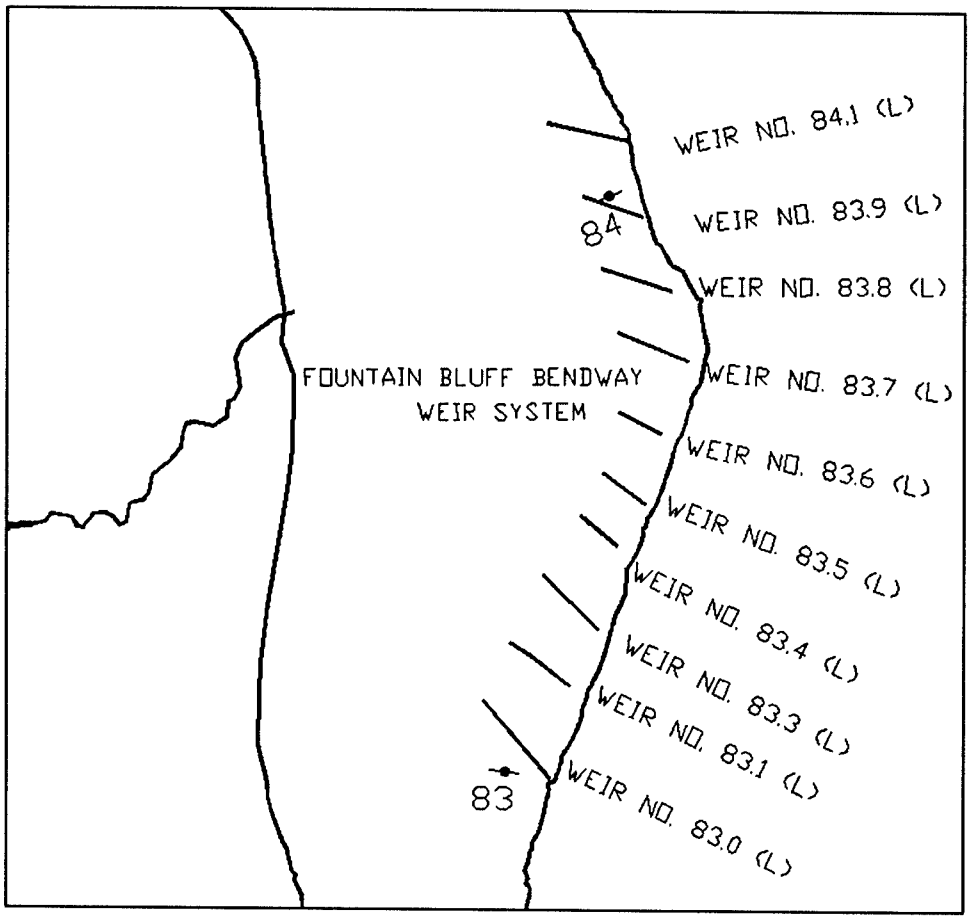


Figure 9. Fountain Bluff

**Red Rock**: (Figure 10) Middle Mississippi, RM 93.7 – 94.8, Completed January 1993, LWRP 331 NGVD

The bend angle is approximately 88 degrees with a radius of 4200 ft. There are nine weirs in the system, which are oriented with the upstream direction at between 63 and 75 degrees. Minimum pre-construction bottom elevations ranged from 292 ft – 307 ft and the weir heights ranged from 9 ft to 24 ft. The post-construction survey indicated a large amount of scour below all the weirs except for the first two upstream. The average water depth on the weirs is 34 ft ranging from 20 ft to 59 ft.

Pilot ratings show a significant improvement in navigation conditions at Red Rock after weir construction. No pilot comments were received for this area.

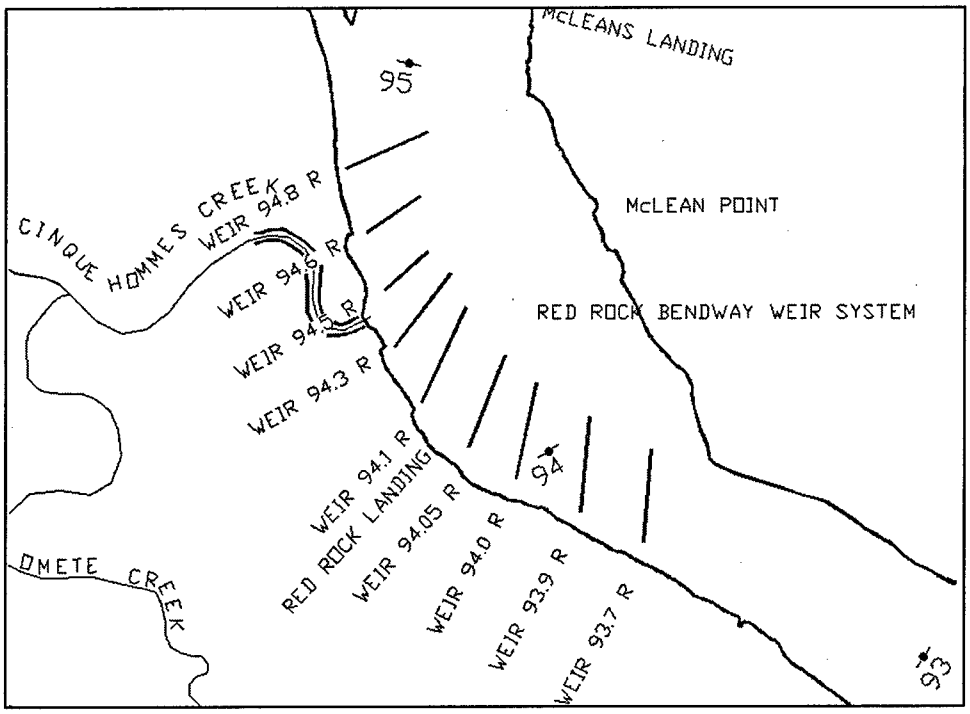


Figure 10. Red Rock

**Kaskaskia Bend**: (Figure 11) Middle Mississippi, RM 116.0 – 117.1, Completed March 1994, LWRP 344.1 NGVD

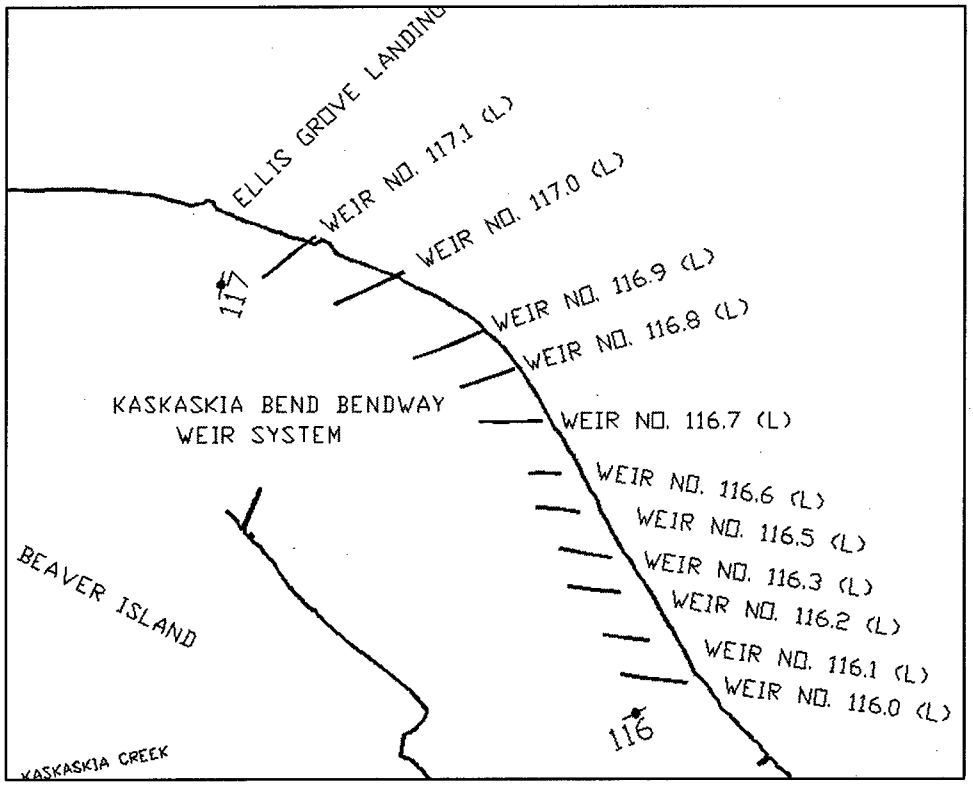


Figure 11. Kaskaskia Bend

The bend angle is approximately 81 degrees with a radius of 5500 ft. There are eleven weirs in the system which are oriented with the upstream direction at between 51 and 69 degrees. Minimum pre-construction bottom elevations ranged from 308 ft to 323 ft and the weir heights ranged from 6 ft to 21 ft. The post-construction survey generally indicated slight scour downstream of the weirs. The average water depth on the weirs is 32 ft ranging from 20 ft to 57 ft.

Pilot ratings show improvement in navigation conditions after weir construction. No pilot comments were directed specifically at Kaskaskia Bend.

**St. Genevieve**: (Figure 12) Middle Mississippi, RM 119.8 – 120.8, Completed September 1997, LWRP 346.4 ft NGVD.

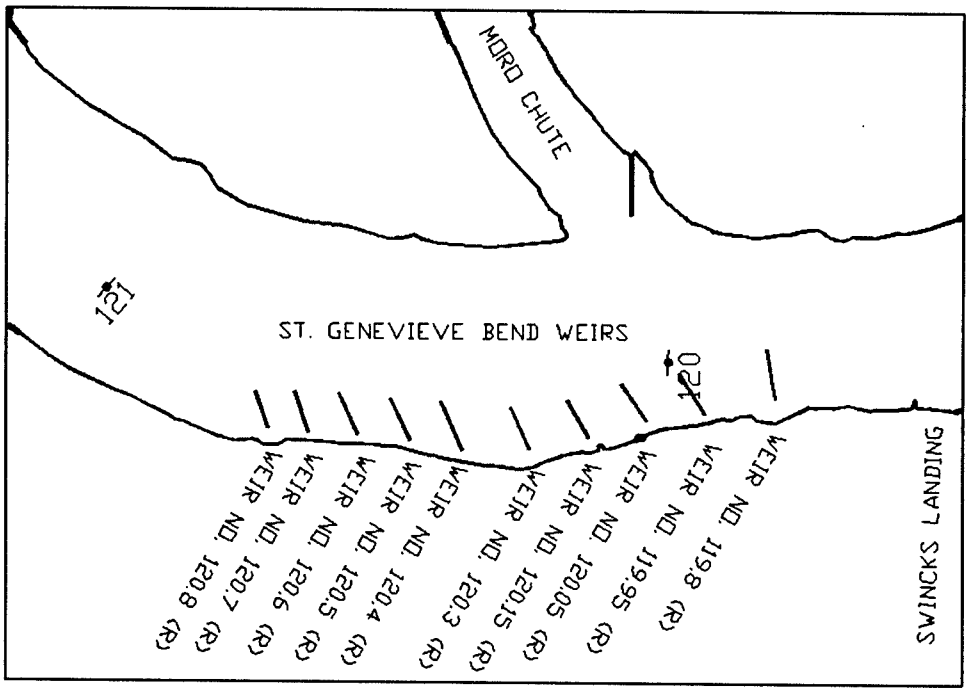


Figure 12. St. Genevieve

The bend angle is 52 degrees with a radius of 10,300 ft. There are ten weirs in the system and they are oriented with the upstream direction at between 56 and 91 degrees. Minimum pre-construction bottom elevations ranged from 314 ft to 323 ft and the weir heights were from 8 ft to 15 ft. No post-construction survey was available for comparative bottom contours. The average water depth over the weirs is 32 ft ranging from 20 ft to 56 ft.

Pilot ratings show improvement in navigation conditions after weir construction.

No pilot comments were directed at the St. Genevieve Bend.

**Fort Chartres**: (Figure 13) Middle Mississippi, RM 129.9 – 131.0, Completed April 1994, LWRP 353.0 ft NGVD.

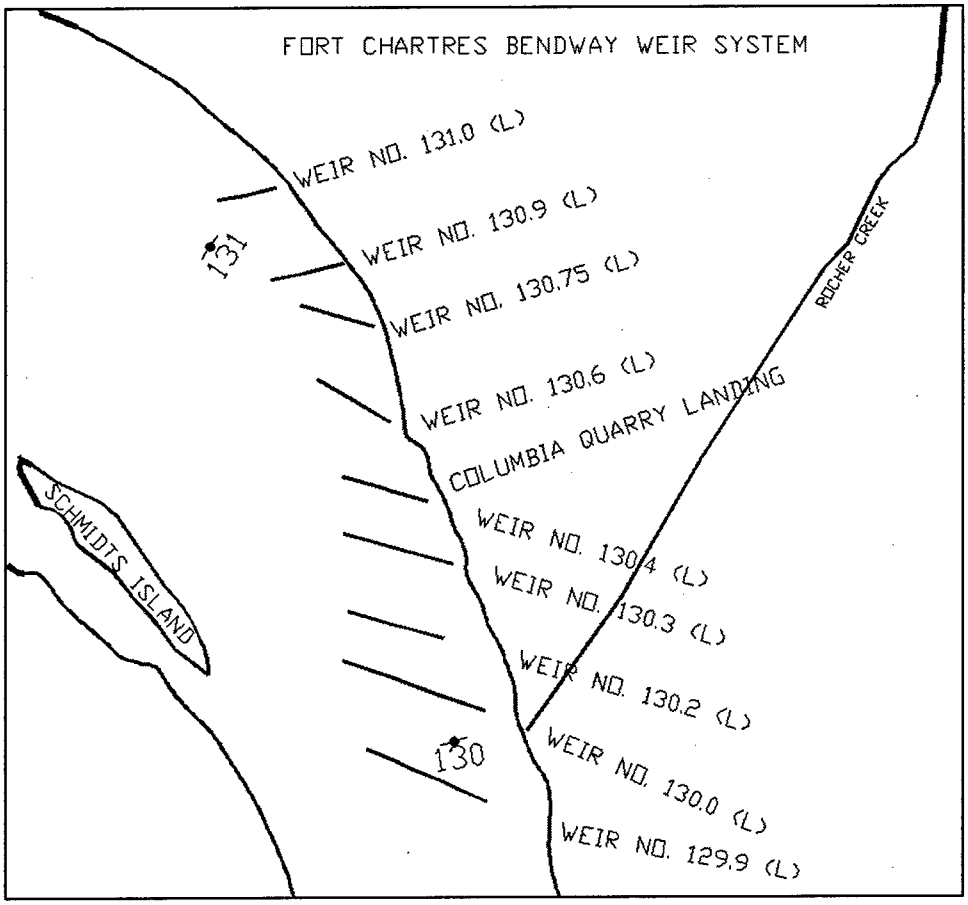


Figure 13. Fort Chartres

The bend angle is 55 degrees and the bend has a radius of 6000 ft. There are nine weirs in the system oriented with the upstream direction between 43 and 70 degrees. There was no pre-construction survey available. The post-construction survey showed significant weir heights toward the middle of the system and low weir heights at the downstream end, this pattern suggests scouring and deposition, respectively. The average water depth over the weirs is 32 ft with a range of 19 ft to 55 ft.

Pilot ratings indicate a degradation of navigation conditions post-construction. This bend is one of the more critical in the Middle Mississippi based on pilot comments:

- Fort Chartres has really been a pain in low flow north and south bound and some in high flow, it pulls the stern out and have to steer down to port to stay off the bank.
- Fort Chartres is also a place to watch real close. No matter how far you get in the bend it is going to draft you out to the bar, if moving slow it is hell handling your tow.
- Fort Chartres seems to be the worst one going N/B. Where these weirs are seems to narrow the channel above them and widen it below them.

- Personally, I like the weir dikes except the ones at Fort Chartres, if you don't watch it, it will get you N/B.

- At Fort Chartres N/B hard draft behind bar at Crooks St. Louis (Gage) 10 ft or below, S/B a little disturbance at Crooks, minor.

- Fort Chartres has had the worst reactions for me upbound – flow wasn't really [reduced]. Pushing a heavy tow N/B up into the bend can be very difficult since construction of weirs.

- The bendway weirs at Ft. Chartres create a difficult condition in low water. The water coming off the weirs is conflicting with the river flow. You have bendway weir water pushing on your starboard stern and river current pushing on your port head. At times the 2 forces easily over come the rudder power of the vessel and make controlling the tow difficult. Similar conditions exist at Victoria Bend LM 594.

- At Fort Chartres very strong draft on bar.

- One of the most severe N/B "SETS" occurs at Fort Chartres during low water. I had a near miss at this location N/B during September 1998 with 20 loads and 4 empties on the 6200 HP Larry Y. Strain. I was favoring the center of the channel watching for the set to the buoys on the lower side of the turn. As I approached the middle of the bend (the turn buoy at the upper end of the weir field), the current coming down above the weirs caught the head of the tow causing it to swing to the left descending bank. I was steering hard down to the port and the tow was still swinging hard to the starboard. I was just about to call LEROY (cause he ain't never seen a wreck like we're fixin to have) when I finally got the swing to the bank to stop. The boat still would not swing the tow to the port with the rudders hard over to the port. The tow stalled out and started to drift back down the river – rudders still hard down to port. As it drifted back it was setting out toward the buoys where the water was slacker. It had drifted back about 1200 feet when it finally started to move ahead and steer around to the port. Looking back now, I was fortunate to have approached the bend as I did. If I had been closer to the buoys coming into the bend, the tow would have stalled and set out on the sandbar behind the buoys.

**Establishment**: (Figure 14) Middle Mississippi, RM 132.7 – 133.0, Completed September 1998, LWRP 354.2 ft NGVD

This weir system is located in a bend with an angle of 34 degrees and a radius of 9700 ft. There are four weirs in the system oriented with the upstream direction at 67 to 74 degrees. The pre-construction hydrographic survey shows bottom elevations ranging from 335 ft to 342 ft with weir heights from 21 ft to 34 ft. No post-construction survey was available. The average water depth over the weirs is 31 ft with a range of 19 ft to 55 ft.

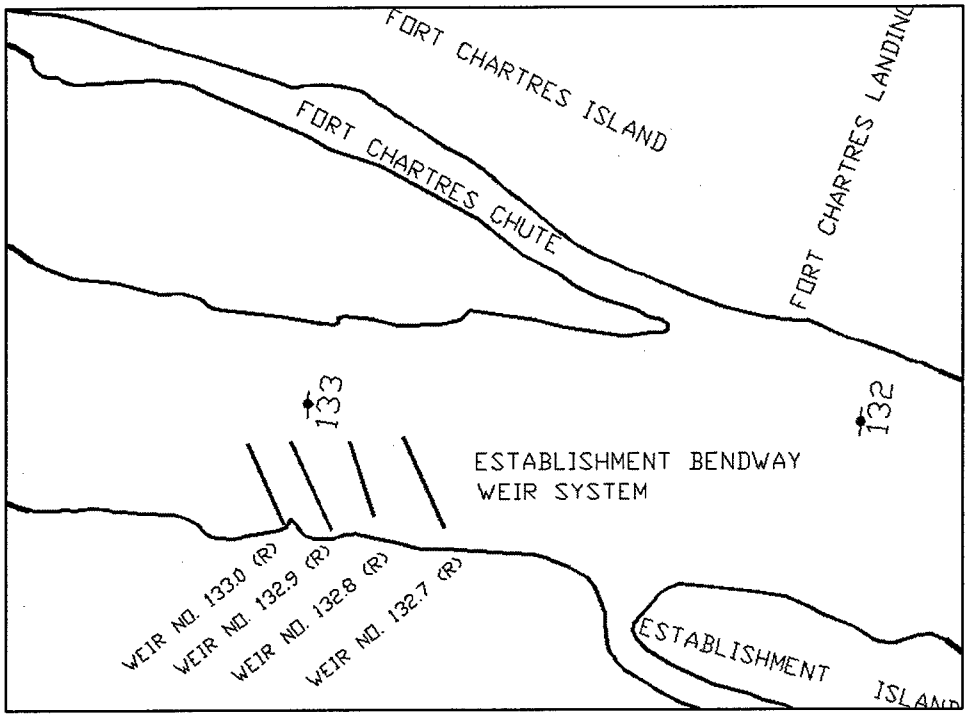


Figure 14. Establishment

Pilot comments and ratings were not collected for this bendway system. These weirs are the latest ones built and, as such, pilots have not formed an opinion yet concerning the navigation impacts.

**Carl Baer:** (Figure 15) Middle Mississippi, RM 163.3 – 164.0, Completed September 1996, LWRP 370.1 ft NGVD.

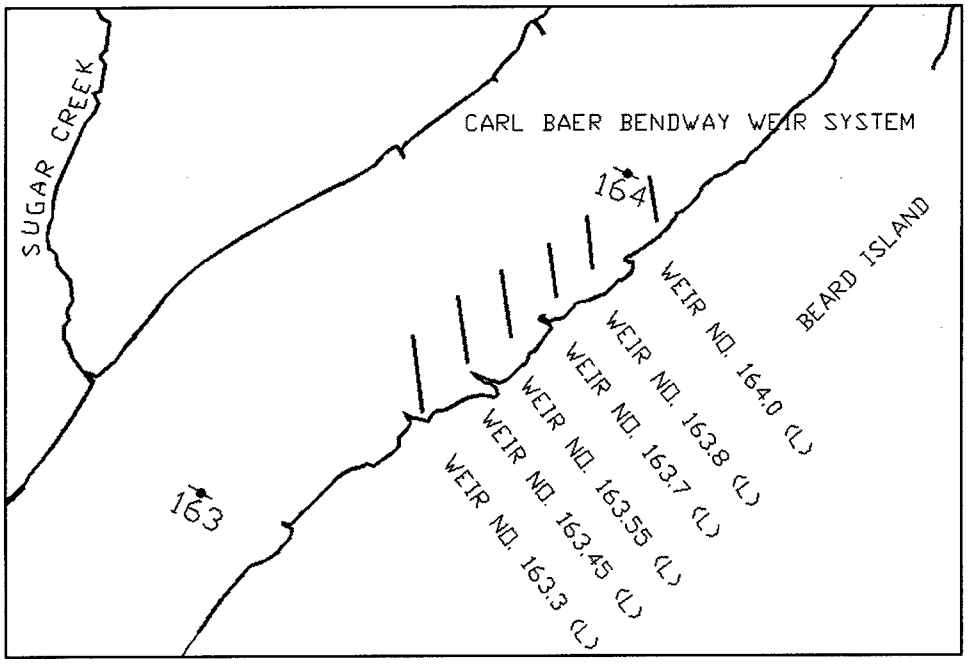


Figure 15. Carl Baer

The bend angle is approximately 39 degrees with a bend radius of 8700 ft. There are six weirs in the system oriented upstream at 61 to 78 degrees. The pre-construction hydrographic survey shows bottom elevations ranging from 325 ft to 350 ft with weir heights from 5 ft to 30 ft. The post-construction survey shows generally more deposition than scouring with weir height ranging from 7 ft to 13 ft. The average water depth over the weirs is 32 ft with a range of 21 ft to 54 ft.

Pilot ratings show an improvement in navigation conditions after weir construction. No pilot comments were received concerning navigation through this bend.

**Bellerive**: (Figure 16) Middle Mississippi, RM 174.0 – 174.7, Completed April 1996, LWRP 374.7 ft NGVD

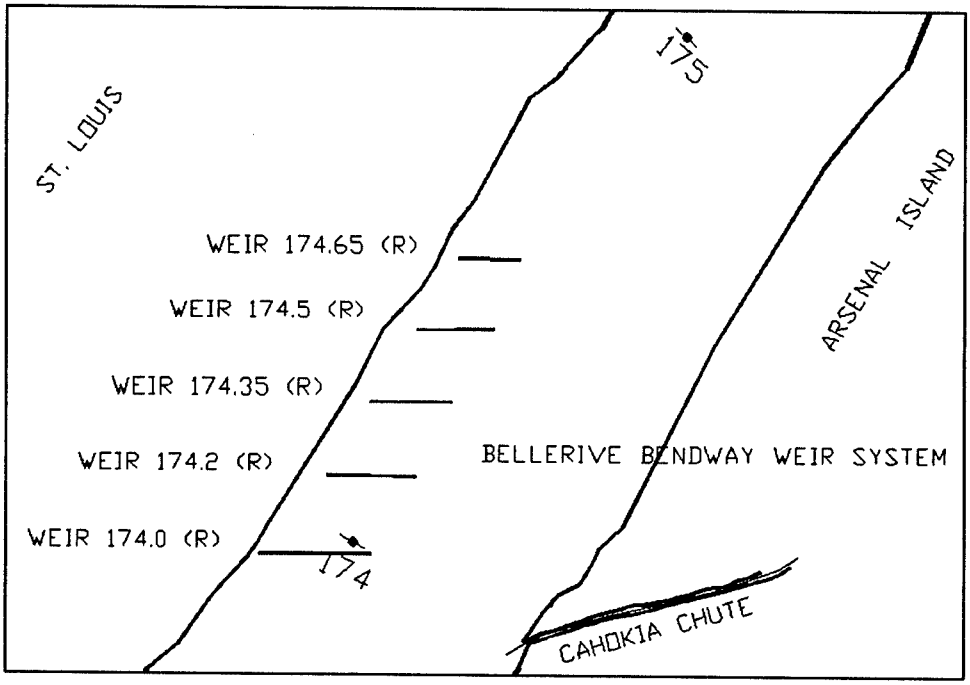


Figure 16. Bellerive

This weir system was constructed in a straight reach past St. Louis. There are five weirs in the system oriented with the upstream direction at 54 to 56 degrees. The pre-construction hydrographic survey shows bottom elevations ranging from 340 ft to 350 ft with weir heights from 8 ft to 15 ft. The post-construction survey shows generally little change in bottom conditions with some scour evident near the downstream weirs. The average water depth over the weirs is 33 ft with a range of 23 ft to 55 ft.

Pilot ratings show an improvement in navigation conditions after weir construction. No pilot comments were received concerning navigation through this reach.

**Mosenthein/Chain of Rocks Canal:** (Figure 17) Middle Mississippi, RM 193.9 – 195.0, Completed April 1997, LWRP 395.9 ft NGVD.

This weir system consists of six weirs split into two groups with four weirs above the mouth of the Chain of Rocks Canal and two below. The bend is gentle with a heading change of 33 degrees and a radius of 11,300 ft. The weirs are oriented with the upstream direction at 57 to 68 degrees. Only a partial pre-construction hydrographic survey was available which shows bottom elevations around 350 ft with weir heights 30 ft. The post-construction survey shows weir heights ranging from 29 to 44 ft. The average water depth over the weirs is 25 ft with a range of 18 ft to 42 ft.

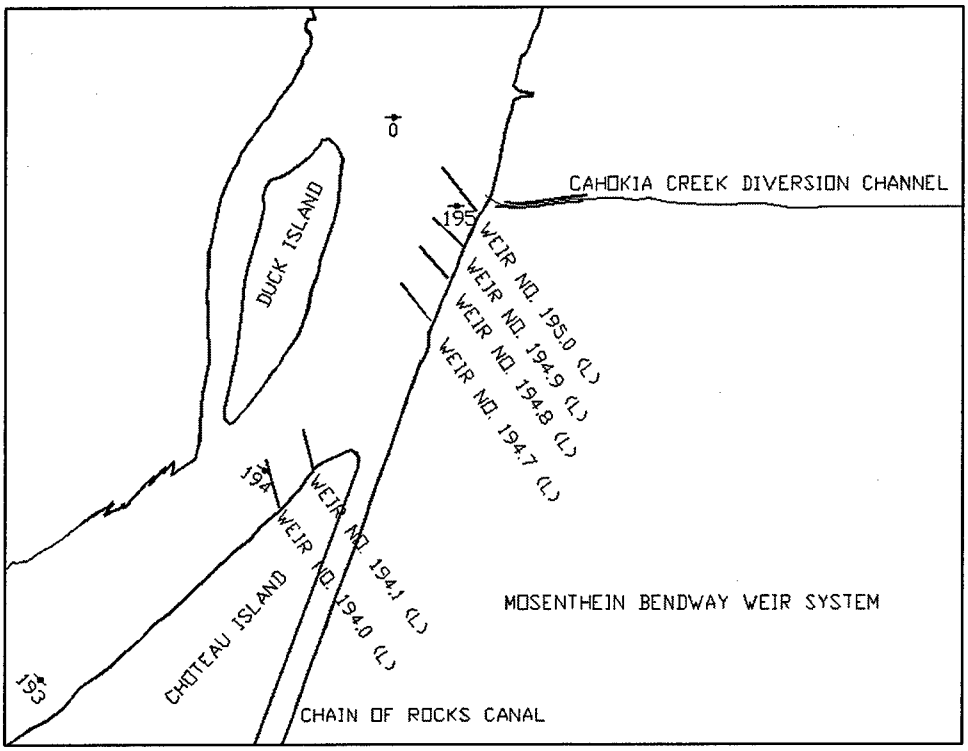


Figure 17 Mosenthein/Chain of Rocks Canal

Pilot ratings show an improvement in navigation conditions after weir construction; however, this conflicts strongly with the comments received:

- The weir above Chain of Rocks Canal is going to cause someone to sink some time. That has caused an extreme draft to the head of the island and you have to shove the left bank downbound.

- Chain of Rocks Canal. The head is becoming a nightmare. For years you try to miss Continental Oil dock, now you better try and hit it, if not you will hit the head of the island, the higher the water the worse its is.

- The Mosenthein weirs should never have been put in. Post construction causes you to hold out more off [?] dock which makes it extremely hard. To get tow back closer to shore to make it in mouth of Chain of Rocks

Canal. At times have had to push harder which puts head loads in danger of going under when they hit slack water at mouth. Also head of tow in toward bank turns stern out.

- The Mosenthein has made the entrance to the Chain of Rocks Canal a little more tricky than what it used to be. The draft is very hard pulling you away from the entrance the higher the flow the worse it gets.

**Victoria Bend**; (Figure 18) Lower Mississippi, RM 594.9 – 595.6, Constructed 1995, LWRP 112.5 ft NGVD

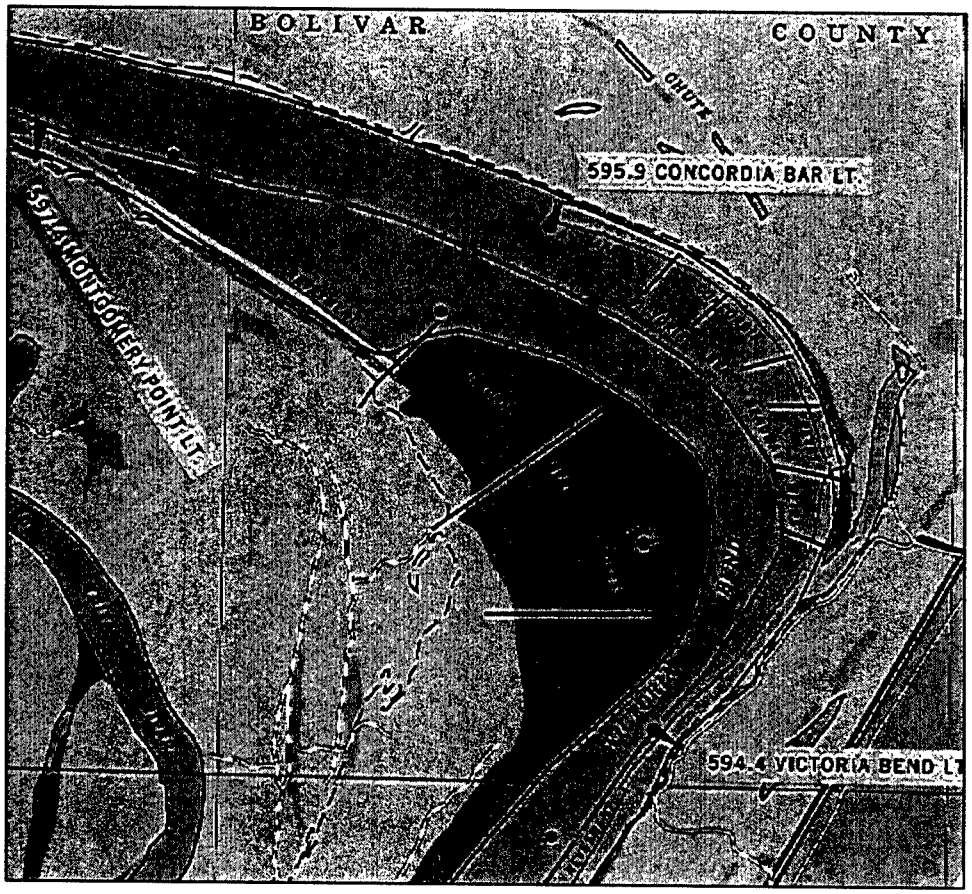


Figure 18. Victory Bend

This weir system consists of six weirs oriented with the upstream direction at 69 to 76 degrees. The bend has a heading change of 108 degrees and a radius of 4200 ft. The pre-construction hydrographic survey shows bottom elevations ranging from 44 ft to 60 ft with weir heights from 24 ft to 43 ft. The post-construction survey shows deposition at the upstream weir and scouring throughout the remainder of the system. The average water depth over the weirs is 37 ft with a range of 22 ft to 63 ft.

Pilot ratings show a degradation of navigation conditions post-construction. The pilots had some harsh comments concerning this bend:

- Victoria Bend - Tow handling is erratic S/B and N/B at all stages.
- Victoria Bend – Tow handling is erratic S/B and N/B at all stages.
- I found that all the bend weirs on the upper Miss. worked good for me.
- But at Victoria Bend, mile 594 LMR, someone goofed.
- Victoria has some bad boils and eddies in The Pocket that get real bad north and south bound at all stages.
- Victoria Bend – weirs have made lower end swifter.
- The bendway weirs at Ft. Chartres create a difficult condition in low water. The water coming off the weirs is conflicting with the river flow. You have bendway weir water pushing on your starboard stern and river current pushing on your port head. At times the 2 forces easily over come the rudder power of the vessel and make controlling the tow difficult. Similar conditions exist at Victoria Bend LM 594.
- Victoria Bend S/B Aug of 1999 a very dangerous place; flanking all the current is running behind Blacks above and below the turn, it wants to quit flanking because there dead water in bend above coming in turn and it will try to top you around on bar. Its very difficulty to flank right now (9-7-99). N/B at Victoria on turn hard drift behind Blacks as tow goes over weirs in the bend. Very stressful with N/B heavy tow.
- Victoria created strong current to bar above weirs and current to shore under them but has been a definite improvement.

# 4 Post Construction Analysis

## Pilot General Comments

In addition to the bend-specific comments, pilot general opinions concerning bendway weirs were received:

- I found that all the bend weirs on the upper Miss. Worked good for me.
- As with anything that effects current flow, weir projects consequentially affect navigation. Each weir field has characteristics that require "GETTING USED TO" after they are installed. Almost all of the projects have a tendency to "SET OUT" on the buoys when you are N/B.
- All-in all the weir projects are a vast improvement over the previous conditions. The only problem I see with the weirs is that in most locations the weir fields do not start far enough toward the upper part of the turn. This causes the middle and lower part of the turns to be about right, but the upper part is narrow and very swift above the weirs. If you have to flank one of them S/B the tow starts out flanking normal on the upper end then stops flanking when you get into the weir field. If you are moving down the river at current speed when this happens you are fixing to "BUTT THE BANK." About all you can do to avoid this is to slow down below current speed and "jerk" the head out of the bend a little to make it start flanking again.
- In all I'm very much in favor for weir dikes. They have done a great job.
- I'm not in favor of putting weir dikes at Bird Point Elevator. It's a bad idea.
- All in all I think the weir dikes have helped navigation a great deal.
- Where even the weir dikes are N/B there is a hard draft when you are coming up under them they will set you hard on the bar the slower moving the tow the harder it sets you.

## Unconstructed Bendway Weir Systems

Two other bendway weir systems are currently being designed in the Lower Mississippi River. The White River weir system is currently being planned for construction near RM 599. For this system several alternative designs have been considered but final plans have not been formalized. The second proposed weir system in the Lower Mississippi has been planned in Walker Bend above the Highway 82 Bridge near RM 532 at Greenville, Mississippi. Final design for the latter weir system has not been completed.

## Analysis of Reported Accidents

The U.S. Coast Guard Marine Casualty and Pollution Investigations Database for the calendar years 1993-1997 was searched for accidents reported at the bendway weir project sites on the Mississippi River. Accidents involving allisions, collisions, and groundings of vessels that occurred within one river mile upstream and downstream of each project were identified and analyzed. Accidents caused by other factors, e.g. equipment failure, etc., were not included in the analysis. The full accident database is shown in Appendix A. A summary of the accidents that occurred within the project sites during the five-year period and following the project construction completion date is presented in Table 3. Because of various project construction dates the values in Table 3 represent different sets of conditions for accidents in each bend; however, comparisons are instructive.

Greenfield, Eliza, Scudders, Picayune, St. Genevieve, and Ft Chartres have not had any recorded accidents since the projects were completed. Dogtooth, Cape Bend, Cape Rock, Red Rock, Mosenthein, and Victoria have all had more than one accident reported - most were groundings. Many involved only small tows (4 or fewer units, e.g. 3 barges and a towboat). Those accidents involving larger tows included:

- Victoria — W.J. Barta — 5 units
- Dogtooth — M/V Harriet Ann — 18 units
- Cape Bend — M/V Arnold Sobel — 5 units
- Cape Bend — M/V Leslie B — 6 units
- Red Rock — M/B Transporter — 9 units
- Kaskaskia — Ray A Eckstein — 23 units

The details of these accidents were not investigated in depth to determine specific cause or to what extent the presence of bendway weirs created critical conditions; however, these statistics do indicate that the weir projects did not eliminate accidents. Dogtooth Bend, Cape Bend, Cape Rock, Mosenthein, and Victoria all averaged at least one accident per year following weir construction.

Mosenthein was completed less than one year during the record but a relatively large number of accidents with small tows continued to occur in the area. Pilot comments collected during this study concerning the Mosenthein/Chain of Rocks vicinity were strong and negative.

Victoria Bend in the Lower Mississippi also had a relatively short history in the accident database after weir construction (about two years) but received significant negative pilot comments – often directed at both upbound and downbound transits. It had the second highest accident rate. However, the sizes of the tows involved in the reported accidents were relatively small (2, 4 and 5 units) compared to the predominant sizes of tows which operate on the Lower Mississippi (25, 30, 35, 42, up to 49 units).

**Table 3. Summary of U.S. Coast Guard Accident Data (1993-1997)**

| Bend | Install. Date | Accidents (after installation) | | | | | | | | | | Number of Vessels | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Grounding | | Collision | | Allision | | Total | | Total/Yr | | | |
| | | All | Post | All | Post | All | Post | All | Post | All | Post | All | Post |
| Greenfield | Oct-95 | 2 | | | | | | 2 | | 0.4 | | 4 | |
| Eliza | Dec-95 | | | | | | | | | | | | |
| Scudders | Dec-95 | 6 | | | | 1 | | 7 | | 1.4 | | 15 | |
| Dogtooth | Dec-90 | 8 | 8 | | | | | 8 | 8 | 1.6 | 1.6 | 34 | 34 |
| Price's Landing | Nov-91 | 1 | 1 | | | | | 1 | 1 | 0.2 | 0.2 | 2 | 2 |
| Cape Bend | Mar-95 | 2 | 1 | 3 | 2 | | | 5 | 3 | 1.0 | 1.1 | 22 | 15 |
| Cape Rock | Feb-92 | 5 | 5 | | | | | 5 | 5 | 1.0 | 1.0 | 10 | 10 |
| Picayune | Feb-95 | 1 | | | | | | 1 | | 0.2 | | 4 | |
| Fountain Bluff | Jan-96 | 4 | 1 | | | | | 4 | 1 | 0.8 | 0.5 | 26 | 2 |
| Red Rock | Jan-93 | 2 | 2 | 1 | 1 | | | 3 | 3 | 0.6 | 0.6 | 17 | 17 |
| Kaskaskia | Mar-94 | 1 | | | | 1 | 1 | 2 | 1 | 0.4 | 0.3 | 27 | 23 |
| St. Genevieve | Sep-97 | | | | | | | | | | | | |
| Ft. Chartres | Apr-94 | | | | | | | | | | | | |
| Carl Baer | Sep-96 | | | | | 1 | 1 | 1 | 1 | 0.2 | 0.8 | 2 | 2 |
| Bellerive | Apr-96 | 1 | 1 | | | | | 1 | 1 | 0.2 | 0.6 | 1 | 1 |
| Mosenthein | Apr-97 | 12 | 6 | | | 2 | 1 | 14 | 7 | 2.8 | 10.5 | 34 | 18 |
| Victoria | 95 | 6 | 4 | 1 | | | | 7 | 4 | 1.4 | 2.0 | 22 | 15 |

While Dogtooth, Cape Bend and Cape Rock received some negative comments, the criticisms were relatively mild compared to others and did not indicate any serious problems. There were comments about a strong draft on the bar at Dogtooth and an eddy at the foot of Cape Rock, but these only came from one or two of the pilots. However, all of these bends had a relatively high number of recorded accidents involving large tows suggesting potential design problems.

Another observation from the analysis of the accident data was that there were no accidents reported near the bend at Ft. Chartres which received many negative comments from the pilots. There was special concern about northbound traffic and currents that made controlling the tows difficult. Apparently, these critical conditions have not resulted in accidents. Other bends that received negative pilot comments, especially for northbound tows and low water conditions, were

Greenfield, Eliza, and Scudders. As with Ft. Chartres, Greenfield and Scudders received some comments about difficult currents; however, Eliza received no pilot comments at all. Greenfield and Scudders had accidents prior to weir construction but none afterward. During the entire period of record no accidents were listed for Eliza bend.

Predominantly, conclusions concerning navigation difficulties drawn from the accident record paint a different picture than conclusions drawn from pilot comments received. It is probable that during numerous critical situations over the years (such as those mentioned in pilot comments) the "chain of events" that usually occurs in accidents did not fully develop and a reportable incident did not result. In such instances evidence of control problems would show up in negative comments but not in the accident database. The converse circumstance in which pilot comments were mild but the accident count was fairly high (Dogtooth, Cape Bend, Cape Rock) is more difficult to account for; however, it is highly unlikely that the pilots surveyed during the present study were the same ones involved in the reported accidents. Currently, a new reporting system is being initiated that will allow the anonymous reporting of incidents that might provide a better indication of navigation difficulties. The fact that several incidents are reported in the pilots' comments is an indication that the proposed system will be helpful in identifying channel reaches that should be considered for corrective action.

## Summary of Survey Results

Each bendway weir project reach was unique and it is difficult to generalize the results of the characteristics. The radius of the bends involved ranged from 4,200 ft to 11,300 ft. The minimum width of the channel after construction ranged from 340 ft to 1,140 ft. The bend angle varied from 33 to 108 degrees. The degree of curvature ranged from 0.51 to 1.36 degrees per ft of arc.

In all of the Upper Mississippi River projects the design height of the weirs was set to –15 ft LWRP, while the only project in the Lower Mississippi River is set to –20 ft LWRP. The number of weirs in a project varied from 4 to 13. Many of the weir systems start deep into the bend relative to the upstream end. The length of the weirs varied from 296 to 1,420 ft with most being 400-700 ft long. The angle of the weirs to the curve tangent was normally between 50 to 75 degrees, ranging from a minimum of 42 to a maximum of 91 degrees. Generally the angles of the weirs were relatively uniform; however, in at least two cases there were unusual combinations of weir angles in the upper reaches of Ft. Chartres and Victoria bends. The minimum depth of water over the weirs ranged from 17.2 to 22.7 ft with the average being about 20 ft. The maximum water depth over the weirs was 66.3 ft. The maximum post-construction depth downstream of the weirs ranged from 16 ft to 85 ft while the nominal weir height post-construction ranged from 0 to 65.5 ft. Generally the weir fields tended to fill in behind the upstream weirs.

Post-construction current patterns were available only for Victoria Bend. These data showed an increase in current magnitude in the navigation channel, more uniformly distributed throughout the channel width. In direction, the

currents tended to be more uniform along the length of the channel post-construction. Because of this, the currents on the inside of the bend, i.e. along the point bar where the upbound tows tend to transit, are increased, sometimes significantly.

## Navigation Changes due to Bendways

Based on the pilots' survey comments and rating sheets, some general trends can be observed in the changes that the weirs made to navigation conditions. Generally speaking, all pilots agreed that the weirs improved navigation conditions for downbound tows. Some comments, received in conversations with port captains, indicated that most projects cause some difficulties immediately after construction on the point bar because currents are increased due to the restricted channel area. The consensus in the towing industry is that for many of the bendway weir systems the channel continues to develop during the post-construction period and navigation difficulties tend to lessen. The survey ratings indicated that most projects showed improvements in the navigation conditions for southbound tows except at Victoria and Cape Rock (under high flow) Bends. Red Rock was rated as having exceptional improvements in both north and southbound directions for both high and low flow conditions. Carl Baer was rated as having been improved in low flow conditions for both upbound and downbound traffic. Scudders was rated as having significant improvements for southbound transits under all flow conditions and Bellerive was rated as having significantly improved overall.

With few exceptions, all projects were indicated to have caused decreased tow speeds upbound over the weirs; due probably to increased current magnitude closer to the point bar where the northbound traffic transits. Greenfield was noted to have the largest decrease in speed, especially during low flows. The majority of pilots indicated erratic control due to turbulent flows for Dogtooth, Ft. Chartres, and Victoria Bends for medium and low flow conditions. More than half of those responding indicated that no erratic control problems occurred for northbound traffic.

Another indication of the improved navigation conditions for southbound traffic was the reduction in flanking required. In all cases and flow conditions, flanking use remained constant or decreased. This was particularly true for low flow conditions at Greenfield, Cape Rock, Fountain Bluff, Red Rock, and Ft. Chartres.

# 5 Test Plan Development

## Considerations for Developing Test Plan

Only two bendway weir projects have received testing for navigation conditions using detailed current measurements and remote-controlled towboats. These are the approaches to the Greenville Bridge and the upstream approach to Montgomery Point Lock and Dam. Neither of these projects has been constructed yet and there is no prototype experience with these projects. However, in both model studies, unfavorable conditions were observed and corrected to some degree.

The initial designs for the Greenville Bridge bendway weir system were developed in a moveable bed model using 25-barge tows. In these design the model weirs were constructed to make the channel widen and push back the point bar from the outside of the bend. These designs were shown in the model to greatly improve the current patterns through the critical turn; however, because the last two weirs continued to be angled upstream and to direct the currents across the channel toward the left downstream bank, the currents tended to force downbound tows to the wrong side of the channel and increased the difficulty of the bridge approach. Changing the angles of these weirs to nearly 90 degrees to the flow corrected the problem. Upbound tows experienced stronger, more erratic currents, decreased tow speed and some control problems, especially when they transited near the end of the weirs on the inside of the bend. If the tows maneuvered so that they transited in the middle of the weirs, they experienced smoother flows and less erratic behavior of the head of the tow. However, the current continued to be stronger than before the weirs were introduced to the navigation channel.

The design tow for the Montgomery Point Lock and Dam project was a 6-barge tow. In the bend just upstream from the approach to the lock and dam, bendway weirs were introduced to improve navigation conditions through the bend and to assist in aligning for the lock and open-pass approach. During testing of the initial design, it was found that the spacing of the weirs was too wide and the tow length for an upbound tow would fit between weirs, i.e. the tow could be in a position where it was in the weir field but would not be over any individual weir. This caused the current pattern to be erratic and caused erratic behavior of upbound tows, creating control problems. This was serious enough that additional weirs were installed so that the tow would be over at least two weirs at all times.

This improved the navigation conditions greatly. In this project the depth of the channel was relatively shallow and the height of the weirs was not great.

## Significant Factors for the Test Plan

The factors that must be considered for developing a bendway weir test plan that will provide guidance for design criteria include:

1. Bendway geometry
   *a.* Radius of the turn,
   *b.* Width of channel (at least the minimum width),
   *c.* Angle of the bend
   *d.* The shape of the channel cross-section, including the maximum depth of the channel bed.
2. Weir design factors
   *a.* Weir crest elevation relative to the low flow conditions
   *b.* Angle of the weir to the flow or tangent of the bend arc
   *c.* Uniformity of the weir angles
   *d.* Weir spacing
   *e.* Starting point of the weir field relative to bend
   *f.* Number of weirs.
3. Flow conditions
   *a.* Varying the discharge
   *b.* Varying the tail water
   *c.* Varying slope of the water surface (however, the water surface slope will generally be determined by the roughness of the channel, including the weir field and will not be controllable to a large extent).
4. Traffic considerations.
   *a.* Tow size (length and width),
   *b.* Tow travel direction,
   *c.* Position of the tow while transiting the weir field, and
   *d.* Whether two-way traffic must be maintained or if the design can allow one-way traffic.

A range of tow sizes in the same channel geometry and weir field layout must be tested as there is some evidence from the accident data and previous model tests that small tows may have more difficulty in a given weir field than larger, more typical design tows.

There are other factors that probably should be considered but, due to limitations in the research project resources, cannot be included. In the development of design criteria for bends, it was found that the distance between bends, i.e. the length of the crossing, influenced the channel width requirements. In one case, Cape Rock, two bends were designed as one bendway weir project and the angles of the weirs developed as if there was only one bend when in fact there were two bends with a very short crossing between them. The other factor found in the projects that have been built that is unusual involves a channel split that occurs in the bend. Mosenthein represents this condition where the Chain of Rocks Canal exits on the outside of the bend and the flow continues in the main part of the channel where the bendway weirs are located. Since this is special project consideration and should probably not be considered in developing general design criteria, this factor will not be considered in development of a test plan.

## Testing Environment, Scale, and Time of Operations

The research program for developing the navigation design guidance for bendway weir projects has been established and initiated. There are three years to perform the test program and $575,000 available for measurements, analysis, and reporting. A test flume has been dedicated to this testing which has dimensions 200ft x 75ft x 2ft with reversible flow up to 20 cubic feet per second (cfs). The test channels will be constructed in packed sand with generic weirs, probably made of tin or aluminum for easy installation and removal. Generally, major changes in channel geometry will require several weeks and will cost approximately $20,000 to execute. Major changes will involve significant movement of sand and will occur when channel widths and radii are changed. Changes in degree of the bend will also require significant construction efforts but may not require the same level of effort that changing the radii and width will require as only a portion of the channel must be modified and the sand will basically be moved from one side of the channel to the other. It is estimated that a change in degree of bend could cost $10,000.

Minor changes will be required to change the weir field layout. This will primarily be accomplished by inserting pre-constructed weir plates at particular angles. Time and cost can be reduced by starting the tests with wide weir spacing in the downstream end of the bend. The weirs can then be added to the upper portion of the bend to determine the impact of extending the weirs upstream into the bend approach channel. As a next step, weirs can be inserted between the widely spaced weirs to determine the impact of weir spacing. After a series of tests for a specific bend geometry and weir angle design, the weirs can be pulled out and reset for different angles with a repeat of the pattern for installing the weirs. At some point, a mixture of weir angles should be tested. It is estimated that it should only take a day or two to make these types of adjustments in the weir fields being tested. These operations will probably require approximately $15,000 per change in weir angles.

Once a channel geometry and weir field is established in the model, various tow sizes, directions of travel and track paths can be tested for different flows and water depths over the weirs. These transits and the resulting current patterns will be recorded using the overhead video tracking system. Estimating approximately 5 runs/hr, a complete set of measurements for one weir angle will require approximately 5 weeks and $11,000.

Based on this analysis of resources and the effort required to perform the necessary model tests and the analysis of the existing bends described above, it was determined that only a limited test program can be undertaken; that is, the large number of factors that need to systematically tested and the resulting combinations of test sets will require more time and funds than are available. Therefore, it is recommended that a limited set of conditions be tested and that the tests focus on determining which factors are most significant in determining safe navigation conditions as early in the testing program as possible. In order to accomplish this, the test program must focus on only a few channel geometries and do as much as possible in varying the layout of the weir fields and tow sizes and transit paths. The tests should focus primarily on upbound transits and a range of tow sizes, including relatively small tows.

It is proposed for the first and second year of the research work $36,000 and $46,000, respectively, be set aside for project management and analysis of the results, and approximately $93,000 be set aside during the final year for management, analysis and reporting. The remainder of the yearly funds will be $164,000, $154,000 and $82,000, respectively, to pay for the proposed model testing program. The proposed testing program will be limited to eight sets of conditions for bend geometry consisting of combinations of two bend radii (4000 ft, 8000 ft), two channel widths (500 ft, 900 ft), and three degrees of bend (110 deg, 75 deg, 60 deg). For each of the eight geometric test conditions, the proposed test program will consist of combinations of three weir angles (45 deg, 60 deg, 75 deg), two flow conditions, three track paths and 3 tow sizes (4, 15, 30) transiting upstream and downstream with either 5, 10 or 20 weirs placed in the bend. The three track paths will be along the outside and inside of the weir system and through the middle. Downbound runs will follow a track path on the outside of the bend only. The 75-deg bend angle will be tested in the 4000-ft radius bend to give some additional information concerning the impact of the degree-of-bend.

| TABLE 4 – Model Testing Program Cost | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Estimated Cost | | | | | | |
| | | Model Costs | | | | | Management | Annual |
| Year | R/W/Deg | Construct | Modify Weirs | Testing | Total | Cumulative | & Analysis | Budget |
| 1 | 4000/500/110 | 20 | 15 | 11 | 46 | 46 | | |
| 1 | 4000/500/75 | 10 | 15 | 11 | 36 | 82 | | |
| 1 | 4000/500/60 | 10 | 15 | 11 | 36 | 118 | | |
| 1 | 8000/500/110 | 20 | 15 | 11 | 46 | 164 | 36 | 200 |
| 2 | 8000/500/60 | 10 | 15 | 11 | 36 | 200 | | |
| 2 | 4000/900/110 | 20 | 15 | 11 | 46 | 246 | | |
| 2 | 4000/900/75 | 10 | 15 | 11 | 36 | 282 | | |
| 2 | 4000/900/60 | 10 | 15 | 11 | 36 | 318 | 46 | 200 |
| 3 | 8000/900/110 | 20 | 15 | 11 | 46 | 364 | | |
| 3 | 8000/900/60 | 10 | 15 | 11 | 36 | 400 | 93 | 175 |

The proposed test channel width of 900 ft is intended to represent a typical bend in a large river system such as the Lower Mississippi. The 500-ft channel width is intended to represent a bend in a relatively smaller river such as the Middle Mississippi or possibly another waterway such as the Red River for which bendway weir systems may be proposed and built in the future. Because of the different focus of these channel width the proposed high and low flow rates to be tested will be different. For the 900-ft channel the test flow rates proposed are based on the January 1995 through December 1998 discharge record from the recording gauge at Arkansas City, Arkansas. The proposed flow rates for this case are based on the cumulative discharge distribution where the $10^{th}$ percentile (low flow) was 288,000 cfs and the $90^{th}$ percentile (high flow) was 1,050,000 cfs. For the 500-ft channel the test flow rates proposed are based on the January 1990 through September 1998 discharge record from Thebes, Illinois. The proposed rates for this case were also based on the cumulative discharge distribution with the $10^{th}$ percentile discharge of 125,000 cfs (low flow) and the $90^{th}$ percentile of 492,000 cfs (high flow).

## Proposed Physical Model Test Plan

The recommended test plan for the first year is as follows:

1. Construct a 500-ft wide channel with a bend of 4000 ft and a deflection angle of 110 degrees. (20K)

    1.1. Place 5 weirs equally spaced in the downstream half of the bend angled with the upstream direction at 45 degrees. (5K)

        1.1.1. Conduct 5 runs for each set of conditions made up of combinations of three tow sizes, two flows, two directions and three track paths. The downbound tests will be limited to a track path along the

outside of the bend. (total 120 runs at 5 runs/hr at $50/hr for technician – 1.2K)

1.2. Add 5 more weirs equally spaced filling out the upstream half of the bend.

1.2.1. Repeat 1.1.1 (1.2K)

1.3. Place additional weirs midway between in-place weirs. Place an additional weir at downstream end to total 20.

1.3.1. Repeat 1.1.1 (1.2K)

1.4. Repeat 1.1 through 1.3 with weirs angled at 60 degrees. (8.6K)

1.5. Repeat 1.1 through 1.3 with weirs angled at 75 degrees. (8.6K)

2. Modify model to change the bend deflection angle to 75 degrees (10K)

2.1. Repeat 1.1 through 1.5 (25.8K)

3. Modify model to change bend deflection angle to 60 degrees (10K)

3.1. Repeat 1.1 through 1.5 (25.8K)

4. Construct a 500-ft wide channel with a bend of 8000 ft and a deflection angle of 110 degrees (20K)

4.1. Repeat 1.1 through 1.5 (25.8K)

The recommended test plan continuation for the second year is as follows:

1. Modify model to change the bend deflection angle to 60 degrees (10K)

1.1. Repeat 1.1 through 1.5 from first year plan (25.8K)

2. Construct a 900-ft channel with a bend radius of 4000 ft and a bend deflection angle of 110 degrees. (20K)

2.1. Repeat 1.1 through 1.5 from first year plan (25.8K)

3. Modify model to change bend deflection angle to 75 degrees (10K)

3.1. Repeat 1.1 through 1.5 from first year plan (25.8K)

4. Modify model to change bend deflection angle to 60 degrees (10K)

4.1. Repeat 1.1 through 1.5 from first year plan (25.8K)

The recommended test plan continuation for the third year is as follows:

1. Construct a 900-ft channel with a bend radius of 8000 ft and a bend deflection angle of 110 degrees (20K)

    1.1. Repeat 1.1 through 1.5 from first year plan (25.8K)

2. Modify model to change bend deflection angle to 60 degrees (10K)

    2.1. Repeat 1.1 through 1.5 from first year plan (25.8K)

# Appendix A
# U.S. Coast Guard Casualty Data (1993 – 1997)

## U.S. Coast Guard Casualty Data (1993-1997)

| Bendway Weirs | Case | Date | Time | Description | Waterway | Mile | Incident Type | Damage | Ves | Vessel Name | Speed | Damage Location |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MC93010781 | 16-Jun-93 | 2145 | GENE NEAL, BREAKAWAY/GROUNDING | LOWER MISSISSIPPI RIVER | 571 | GROUNDING | $8,000.00 | 5 | MM-72 | 6 | STARBOARD MIDSHIP HALF LENGTH |
| | MC93010781 | 16-Jun-93 | 2145 | GENE NEAL, BREAKAWAY/GROUNDING | LOWER MISSISSIPPI RIVER | 571 | GROUNDING | $8,000.00 | 5 | MM-70 | | STARBOARD QUARTER |
| | MC95014718 | 14-Sep-95 | 30 | M/V STEVE T | LOWER MISSISSIPPI RIVER | 584 | GROUNDING | $0.00 | 2 | RW 251 | | PORT BOW |
| | MC94005736 | 21-Mar-94 | 2245 | M/V SUSAN K & M/V MR. TOM | LOWER MISSISSIPPI RIVER | 585 | COLLISION | $33,900.00 | 5 | ITC 120 | | PORT BOW |
| | MC94005736 | 21-Mar-94 | 2245 | M/V SUSAN K & M/V MR. TOM | LOWER MISSISSIPPI RIVER | 585 | COLLISION | $33,900.00 | 5 | BUNGE 117 | | STARBOARD QUARTER |
| | MC94005736 | 21-Mar-94 | 2245 | M/V SUSAN K & M/V MR. TOM | LOWER MISSISSIPPI RIVER | 585 | COLLISION | $33,900.00 | 5 | BUNGE 871B | | STARBOARD QUARTER |
| | MC97005443 | 31-Mar-97 | 840 | M/V JO ANNE STEGBAUER | LOWER MISSISSIPPI RIVER | 586 | GROUNDING | not noted | 2 | JO ANNE STEGBAUER | | PORT BOW |
| | MC96002790 | 18-Feb-96 | 1730 | AARON G COLLISION | LOWER MISSISSIPPI RIVER | 588 | COLLISION | not noted | 3 | RUBY LOUISE | | NOT NOTED |
| | MC93020529 | 10-Nov-93 | 830 | M/V ANDREW CARGILL MACMILLAN | LOWER MISSISSIPPI RIVER | 590 | GROUNDING | $50,000.00 | 6 | XL 268 | | PORT BOW |
| | MC93020529 | 10-Nov-93 | 830 | M/V ANDREW CARGILL MACMILLAN | LOWER MISSISSIPPI RIVER | 590 | GROUNDING | $50,000.00 | 6 | XL 297 | | PORT BOW |
| | MC93020529 | 10-Nov-93 | 830 | M/V ANDREW CARGILL MACMILLAN | LOWER MISSISSIPPI RIVER | 590 | GROUNDING | $50,000.00 | 6 | XL 152 | | PORT BOW |
| | MC93020529 | 10-Nov-93 | 830 | M/V ANDREW CARGILL MACMILLAN | LOWER MISSISSIPPI RIVER | 590 | GROUNDING | $50,000.00 | 6 | ANDREW CARGILL MACMILLAN | | STARBOARD QUARTER |
| | MC95003324 | 23-Feb-95 | 2342 | M/V ROBERT N. STOUT | LOWER MISSISSIPPI RIVER | 591 | EQUIP FAIL | $20,000.00 | 2 | MF 91 | | NOT NOTED |
| Victoria | MC97014605 | 2-Oct-97 | 150 | M/V OLINDA- C | LOWER MISSISSIPPI RIVER | 594 | GROUNDING | $8,500.00 | 2 | DC 374 | | STARBOARD BOW |
| Victoria | MC95004074 | 10-Mar-95 | 330 | M/V RANDY ECKSTEIN | LOWER MISSISSIPPI RIVER | 594 | GROUNDING | $1,500.00 | 4 | AGS 703 | | NOT NOTED |
| Victoria | MC95004074 | 10-Mar-95 | 330 | M/V RANDY ECKSTEIN | LOWER MISSISSIPPI RIVER | 594 | GROUNDING | $1,500.00 | 4 | NOMA 249 | | NOT NOTED |
| Victoria | MC95014236 | 6-Sep-95 | 545 | W.J. BARTA, GROUNDING | LOWER MISSISSIPPI RIVER | 594 | GROUNDING | $9,045.00 | 5 | VL 7601 | 3 | PORT BOW |
| Victoria | MC95014236 | 6-Sep-95 | 545 | W.J. BARTA, GROUNDING | LOWER MISSISSIPPI RIVER | 594 | GROUNDING | $9,045.00 | 5 | ACBL 3051 | 3 | PORT QUARTER |
| Victoria | MC95014236 | 6-Sep-95 | 545 | W.J. BARTA, GROUNDING | LOWER MISSISSIPPI RIVER | 594 | GROUNDING | $9,045.00 | 5 | VLX 7350 | 3 | STARBOARD QUARTER |
| Victoria | MC95014236 | 6-Sep-95 | 545 | W.J. BARTA, GROUNDING | LOWER MISSISSIPPI RIVER | 594 | GROUNDING | $9,045.00 | 5 | GII 108 | 3 | STARBOARD QUARTER |
| Victoria | MC95016408 | 10-Oct-95 | 900 | M/V DONNA RUSHING | LOWER MISSISSIPPI RIVER | 594 | GROUNDING | $35,000.00 | 4 | CH 9379 | | NOT NOTED |
| Victoria | MC93002445 | 5-Feb-93 | 1845 | BILL ANDREWS COLLIDED WITH | LOWER MISSISSIPPI RIVER | 595 | COLLISION | $22,000.00 | 4 | SC 305 S | | PORT MIDSHIP HALF LENGTH |
| Victoria | MC93002445 | 5-Feb-93 | 1845 | BILL ANDREWS COLLIDED WITH | LOWER MISSISSIPPI RIVER | 595 | COLLISION | $22,000.00 | 4 | CBX 223 | | STARBOARD BOW |
| Victoria | MC94000227 | 2-Jan-94 | 1854 | LAINEY JONES, GROUNDING | LOWER MISSISSIPPI RIVER | 595 | GROUNDING | $26,214.00 | 5 | PV 5977 | | PORT BOW |
| Victoria | MC94025931 | 10-Nov-94 | 2245 | M/V JOSEPH RAY | LOWER MISSISSIPPI RIVER | 595 | GROUNDING | $0.00 | 2 | EFC 9216 | | NOT NOTED |
| | MC97013587 | 21-Sep-97 | 2325 | M/V NEBRASKA CITY | LOWER MISSISSIPPI RIVER | 598 | GROUNDING | $0.00 | 3 | OR 307 | | STARBOARD BOW |
| | MC96009621 | 7-Jun-96 | 1630 | S/R KENTUCKY | LOWER MISSISSIPPI RIVER | 598 | GROUNDING | not noted | 4 | S/R BARGE NO 204 | | NOT NOTED |
| | MC96009621 | 7-Jun-96 | 1630 | S/R KENTUCKY | LOWER MISSISSIPPI RIVER | 598 | GROUNDING | not noted | 4 | S R BARGE NO. 401 | | NOT NOTED |
| | MC96009621 | 7-Jun-96 | 1630 | S/R KENTUCKY | LOWER MISSISSIPPI RIVER | 598 | GROUNDING | not noted | 4 | S R BARGE NO. 411 | | NOT NOTED |
| | MC96001747 | 2-Feb-96 | 1030 | M/V J S MCDERMOTT | LOWER MISSISSIPPI RIVER | 599 | GROUNDING | $500.00 | 2 | T 3043 | | STARBOARD BOW |
| | MC95015208 | 24-Sep-95 | 850 | M/V STONE POWER | LOWER MISSISSIPPI RIVER | 610 | GROUNDING | not noted | 3 | S 29 | | NOT NOTED |
| | MC95015208 | 24-Sep-95 | 850 | M/V STONE POWER | LOWER MISSISSIPPI RIVER | 610 | GROUNDING | not noted | 3 | S-25 | | NOT NOTED |
| | MC93020151 | 4-Nov-93 | 2155 | JOSEPH MERRICK JONES, AGROUND | LOWER MISSISSIPPI RIVER | 611 | GROUNDING | $0.00 | 6 | AGS 627B | | STARBOARD BOW |
| | MC93020151 | 4-Nov-93 | 2155 | JOSEPH MERRICK JONES, AGROUND | LOWER MISSISSIPPI RIVER | 611 | GROUNDING | $0.00 | 6 | AGS 639B | | STARBOARD BOW |
| | MC93020151 | 4-Nov-93 | 2155 | JOSEPH MERRICK JONES, AGROUND | LOWER MISSISSIPPI RIVER | 611 | GROUNDING | $0.00 | 6 | AGS 658B | | STARBOARD BOW |
| | MC93020151 | 4-Nov-93 | 2155 | JOSEPH MERRICK JONES, AGROUND | LOWER MISSISSIPPI RIVER | 611 | GROUNDING | $0.00 | 6 | CA527 | | STARBOARD BOW |
| | MC93007014 | 21-Apr-93 | 950 | CGB/WATERFRONT #5 & #6 FLEETS | UPPER MISSISSIPPI RIVER | 0 | BREAKAWAY | NOT NOTED | 4 | CGB 166 | | PORT BOW |
| | MC94003309 | 16-Feb-94 | 2155 | M/V BOB STITH 0 UMR | UPPER MISSISSIPPI RIVER | 0 | COLLISION | $8,300.00 | 4 | MM 70 | 3 | STARBOARD BOW |
| | MC94003309 | 16-Feb-94 | 2155 | M/V BOB STITH 0 UMR | UPPER MISSISSIPPI RIVER | 0 | COLLISION | $8,300.00 | 4 | ACBL 1267 | 1 | PORT BOW |
| | MC96013331 | 26-Aug-96 | 5 | M/V JO ANNE STEGBAUER 1.3, UMR | UPPER MISSISSIPPI RIVER | 1 | ALLISION | $750.00 | 2 | N.M.S. NO. 2507 | | PORT QUARTER |
| | MC96010039 | 3-Jul-96 | 2140 | M/V TWYLA A. 01.3 UMR | UPPER MISSISSIPPI RIVER | 1 | ALLISION | $175,000.00 | 3 | L 211B | | STARBOARD QUARTER |
| | MC96010039 | 3-Jul-96 | 2140 | M/V TWYLA A. 01.3 UMR | UPPER MISSISSIPPI RIVER | 1 | ALLISION | $175,000.00 | 3 | L-331 | | STARBOARD QUARTER |
| | MC95005697 | 7-Apr-95 | 330 | M/V GLORIA G. 001 UMR | UPPER MISSISSIPPI RIVER | 1 | ALLISION | $156,000.00 | 3 | BUNGE 344 | 10 | PORT BOW |
| | MC95005697 | 7-Apr-95 | 330 | M/V GLORIA G. 001 UMR | UPPER MISSISSIPPI RIVER | 1 | ALLISION | $156,000.00 | 3 | AGS 951 | 10 | STARBOARD BOW |
| | MC95007820 | 12-May-95 | 150 | M/V INGLE L. TOLEN 1.3 UMR | UPPER MISSISSIPPI RIVER | 1 | ALLISION | $50,000.00 | 2 | M128 | | PORT MIDSHIP HALF LENGTH |
| | MC93006463 | 14-Apr-93 | 2210 | ALL: M/V J.M. JONES W/CAIRO BR | UPPER MISSISSIPPI RIVER | 1 | ALLISION | $30,000.00 | 3 | RB 3 | 8 | PORT MIDSHIP HALF LENGTH |
| | MC93006463 | 14-Apr-93 | 2210 | ALL: M/V J.M. JONES W/CAIRO BR | UPPER MISSISSIPPI RIVER | 1 | ALLISION | $30,000.00 | 3 | RBZ 6 | 8 | PORT BOW |
| | MC93008737 | 14-May-93 | 1100 | M/V CITY OF HUNTINGTON 01.3 UM | UPPER MISSISSIPPI RIVER | 1 | ALLISION | $40,000.00 | 3 | CBL 308 | | STARBOARD QUARTER |
| | MC93008737 | 14-May-93 | 1100 | M/V CITY OF HUNTINGTON 01.3 UM | UPPER MISSISSIPPI RIVER | 1 | ALLISION | $40,000.00 | 3 | OR 3629 | | STARBOARD QUARTER |
| | MC93012770 | 5-Jul-93 | 315 | M/V STEVE T | UPPER MISSISSIPPI RIVER | 1 | ALLISION | $86,000.00 | 2 | PV3959 | | PORT MIDSHIP HALF LENGTH |
| | MC93016031 | 3-Sep-93 | 2350 | M/V ALOIS LUHR | UPPER MISSISSIPPI RIVER | 1 | ALLISION | NOT NOTED | 2 | L-1021 | 3 | STARBOARD MIDSHIP HALF LENGTH |
| | MC93018484 | 7-Oct-93 | 2030 | M/V RANDY ECKSTEIN 001 UMR | UPPER MISSISSIPPI RIVER | 1 | ALLISION | $345,150.00 | 4 | T-7951 | | PORT QUARTER |
| | MC93018484 | 7-Oct-93 | 2030 | M/V RANDY ECKSTEIN 001 UMR | UPPER MISSISSIPPI RIVER | 1 | ALLISION | $345,150.00 | 4 | CC251B | | STARBOARD MIDSHIP HALF LENGTH |
| | MC93018484 | 7-Oct-93 | 2030 | M/V RANDY ECKSTEIN 001 UMR | UPPER MISSISSIPPI RIVER | 1 | ALLISION | $345,150.00 | 4 | BUNGE 713 | | PORT QUARTER |
| | MC93017019 | 19-Sep-93 | 1635 | CRIMSON DUKE 02.5 UMR | UPPER MISSISSIPPI RIVER | 2 | ALLISION | $65,500.00 | 2 | XL 144 | 6 | STARBOARD BOW |
| | MC93009608 | 27-May-93 | 2345 | GRD: M/V DANIEL WEBSTER 2.4 UM | UPPER MISSISSIPPI RIVER | 2 | GROUNDING | $24,020.00 | 4 | DANIEL WEBSTER | | STARBOARD QUARTER |
| | MC93009608 | 27-May-93 | 2345 | GRD: M/V DANIEL WEBSTER 2.4 UM | UPPER MISSISSIPPI RIVER | 2 | GROUNDING | $24,020.00 | 4 | DM 2575 | | PORT QUARTER |
| | MC93009608 | 27-May-93 | 2345 | GRD: M/V DANIEL WEBSTER 2.4 UM | UPPER MISSISSIPPI RIVER | 2 | GROUNDING | $24,020.00 | 4 | SER 182 B | | PORT BOW |
| | MC93009608 | 27-May-93 | 2345 | GRD: M/V DANIEL WEBSTER 2.4 UM | UPPER MISSISSIPPI RIVER | 2 | GROUNDING | $24,020.00 | 4 | 1314 | | PORT BOW |
| | MC93009608 | 27-May-93 | 2345 | GRD: M/V DANIEL WEBSTER 2.4 UM | UPPER MISSISSIPPI RIVER | 2 | GROUNDING | $24,020.00 | 4 | 1314 | | STARBOARD QUARTER |

| Bendway Weirs | Case | Date | Time | Description | Waterway | Mile | Incident Type | Damage | Ves | Vessel Name | Speed | Damage Location |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Greenfield | MC95013449 | 18-Jul-95 | 1900 | M/V BOB STITH 03 UMR | UPPER MISSISSIPPI RIVER | 3 | GROUNDING | $750.00 | 2 | ACBL 2889 | | PORT MIDSHIP HALF LENGTH |
| Greenfield | MC93002595 | 10-Feb-93 | 2240 | GRD: M/V RITA BARTA MI. 3.0 UM | UPPER MISSISSIPPI RIVER | 3 | GROUNDING | $0.00 | 2 | SCNO 8013 | 3 | PORT QUARTER |
| Eliza | MC95010641 | 4-Jul-95 | 1900 | M/V LARRY Y. STRAIN 5 UMR | UPPER MISSISSIPPI RIVER | 5 | EQUIP FAIL | $12,000.00 | 8 | SCNO 8012 | 2 | STARBOARD BOW |
| Eliza | MC95010641 | 4-Jul-95 | 1900 | M/V LARRY Y. STRAIN 5 UMR | UPPER MISSISSIPPI RIVER | 5 | EQUIP FAIL | $12,000.00 | 8 | TTBL 4005 | 2 | STARBOARD BOW |
| Eliza | MC96013993 | 11-Sep-96 | 530 | M/V CONNELL SMITH 7.4 UMR | UPPER MISSISSIPPI RIVER | 7 | EQUIP FAIL | not noted | 2 | CONNELL SMITH | 7 | PORT MIDSHIP HALF LENGTH |
| Eliza | MC96013993 | 11-Sep-96 | 530 | M/V CONNELL SMITH 7.4 UMR | UPPER MISSISSIPPI RIVER | 7 | EQUIP FAIL | not noted | 2 | MTC 103B | 7 | PORT MIDSHIP HALF LENGTH |
| | MC93020542 | 10-Nov-93 | 1120 | M/V SHEILA JOHNSON 12.5 UMR | UPPER MISSISSIPPI RIVER | 12 | GROUNDING | $0.00 | 3 | DC-370 | 5 | STARBOARD BOW |
| | MC93009605 | 27-May-93 | 1700 | COL: M/V JEFFBOAT/HUFFMAN 13.8 | UPPER MISSISSIPPI RIVER | 13 | COLLISION | $41,000.00 | 5 | ACBL 312X | | PORT QUARTER |
| | MC93009605 | 27-May-93 | 1700 | COL: M/V JEFFBOAT/HUFFMAN 13.8 | UPPER MISSISSIPPI RIVER | 13 | COLLISION | $41,000.00 | 5 | H 121 B | | PORT QUARTER |
| | MC93009605 | 27-May-93 | 1700 | COL: M/V JEFFBOAT/HUFFMAN 13.8 | UPPER MISSISSIPPI RIVER | 13 | COLLISION | $41,000.00 | 5 | CGB 341 | | PORT BOW |
| Scudders | MC95001710 | 30-Jan-95 | 1750 | M/V GLORIA G. 16 UMR | UPPER MISSISSIPPI RIVER | 16 | GROUNDING | $6,500.00 | 2 | AGS 528 | | PORT BOW |
| Scudders | MC94025510 | 14-Dec-94 | 615 | M/V RANDY ECKSTEIN 16 UMR | UPPER MISSISSIPPI RIVER | 16 | GROUNDING | $5,000.00 | 2 | CC8312 | 6 | PORT BOW |
| Scudders | MC94026109 | 27-Dec-94 | 135 | M/V CONTI SUSAN 16 UMR | UPPER MISSISSIPPI RIVER | 16 | GROUNDING | $12,000.00 | 2 | CCT 77 | 2 | STARBOARD BOW |
| Scudders | MC95000511 | 16-Dec-94 | 1240 | M/V W.T. TOUTANT 16 UMR | UPPER MISSISSIPPI RIVER | 16 | GROUNDING | $6,400.00 | 2 | ACBL 307X | 2 | PORT BOW |
| Scudders | MC93001019 | 17-Jan-93 | 900 | GRD: TUG-TOW 16.6 UMR | UPPER MISSISSIPPI RIVER | 16 | GROUNDING | $200.00 | 3 | CBX 36 | | PORT BOW |
| Scudders | MC93020065 | 3-Nov-93 | 1150 | UMR 16.8 M/V MIDLAND STAR | UPPER MISSISSIPPI RIVER | 16 | GROUNDING | NOT NOTED | 2 | ORG 2559 | | PORT BOW |
| Scudders | MC95001598 | 27-Jan-95 | 1325 | M/V WILLIAM F. PLETTNER 17 UMR | UPPER MISSISSIPPI RIVER | 17 | ALLISION | $4,000.00 | 2 | CGB 123 | | PORT QUARTER |
| Scudders | MC97015426 | 22-Sep-97 | 130 | M/V ROBERT N. STOUT 17 UMR | UPPER MISSISSIPPI RIVER | 17 | EQUIP FAIL | $250.00 | 1 | ROBERT N. STOUT | | PORT QUARTER |
| | MC96016893 | 11-Nov-96 | 355 | M/V CORAL DAWN, MILE 20 UMR | UPPER MISSISSIPPI RIVER | 19 | GROUNDING | $2,000.00 | 2 | TRI 27 | 4 | PORT BOW |
| | MC95014651 | 14-Sep-95 | 430 | M/V SHARIN K. W/TOWS: GROUNDED | UPPER MISSISSIPPI RIVER | 19 | GROUNDING | not noted | 2 | MBL 414 | 8 | STARBOARD BOW |
| | MC95014114 | 28-Aug-95 | 215 | M/V CONTI SUSAN 20 UMR | UPPER MISSISSIPPI RIVER | 20 | GROUNDING | $500.00 | 3 | AGS 974 | | PORT BOW |
| | MC95014114 | 28-Aug-95 | 215 | M/V CONTI SUSAN 20 UMR | UPPER MISSISSIPPI RIVER | 20 | GROUNDING | $500.00 | 3 | NOMA 220 | | PORT BOW |
| | MC93009025 | 23-May-93 | 2345 | COL: M/V MACMILLAN/FILE 22 UMR | UPPER MISSISSIPPI RIVER | 21 | COLLISION | $42,500.00 | 6 | SER 234 | | STARBOARD BOW |
| | MC93009025 | 23-May-93 | 2345 | COL: M/V MACMILLAN/FILE 22 UMR | UPPER MISSISSIPPI RIVER | 21 | COLLISION | $42,500.00 | 6 | BUNGE 492 | | STARBOARD QUARTER |
| | MC93009025 | 23-May-93 | 2345 | COL: M/V MACMILLAN/FILE 22 UMR | UPPER MISSISSIPPI RIVER | 21 | COLLISION | $42,500.00 | 6 | DM 2807 | | STARBOARD QUARTER |
| Dogtooth | MC96017668 | 26-Nov-96 | 2315 | M/V HARRIET ANN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $148,500.00 | 18 | PML 713 | | STARBOARD QUARTER |
| Dogtooth | MC96017668 | 26-Nov-96 | 2315 | M/V HARRIET ANN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $148,500.00 | 18 | RW 836B | | STARBOARD QUARTER |
| Dogtooth | MC96017668 | 26-Nov-96 | 2315 | M/V HARRIET ANN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $148,500.00 | 18 | RW 538B | | STARBOARD QUARTER |
| Dogtooth | MC96017668 | 26-Nov-96 | 2315 | M/V HARRIET ANN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $148,500.00 | 18 | RW 123 | | STARBOARD QUARTER |
| Dogtooth | MC96017668 | 26-Nov-96 | 2315 | M/V HARRIET ANN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $148,500.00 | 18 | RW 243 | | STARBOARD QUARTER |
| Dogtooth | MC96017668 | 26-Nov-96 | 2315 | M/V HARRIET ANN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $148,500.00 | 18 | RW 607 | | STARBOARD QUARTER |
| Dogtooth | MC96017668 | 26-Nov-96 | 2315 | M/V HARRIET ANN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $148,500.00 | 18 | RW 822B | | STARBOARD QUARTER |
| Dogtooth | MC96017668 | 26-Nov-96 | 2315 | M/V HARRIET ANN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $148,500.00 | 18 | MBL 416 | | STARBOARD QUARTER |
| Dogtooth | MC96017668 | 26-Nov-96 | 2315 | M/V HARRIET ANN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $148,500.00 | 18 | RW 602 | | STARBOARD QUARTER |
| Dogtooth | MC96017668 | 26-Nov-96 | 2315 | M/V HARRIET ANN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $148,500.00 | 18 | MBL 408 | | STARBOARD QUARTER |
| Dogtooth | MC96017668 | 26-Nov-96 | 2315 | M/V HARRIET ANN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $148,500.00 | 18 | H 110 B | | STARBOARD QUARTER |
| Dogtooth | MC96017668 | 26-Nov-96 | 2315 | M/V HARRIET ANN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $148,500.00 | 18 | H 111 B | | STARBOARD QUARTER |
| Dogtooth | MC96017668 | 26-Nov-96 | 2315 | M/V HARRIET ANN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $148,500.00 | 18 | ABC 349 | | PORT BOW |
| Dogtooth | MC96017668 | 26-Nov-96 | 2315 | M/V HARRIET ANN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $148,500.00 | 18 | MDR 9608-B | | PORT QUARTER |
| Dogtooth | MC96017668 | 26-Nov-96 | 2315 | M/V HARRIET ANN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $148,500.00 | 18 | RW 660B | | STARBOARD QUARTER |
| Dogtooth | MC95001951 | 10-Jan-95 | 1100 | M/V LARRY Y. STRAIN 22 UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $1,200.00 | 2 | VL 81228 | 2 | PORT MIDSHIP HALF LENGTH |
| Dogtooth | MC95006055 | 9-Apr-95 | 1930 | M/V RANDY ECKSTEIN 22.6, UMR | UPPER MISSISSIPPI RIVER | 22 | GROUNDING | $1,000.00 | 2 | ING 5063 | | STARBOARD BOW |
| Dogtooth | MC94011157 | 3-Jun-94 | 1300 | M/V HENRY B. 23 UMR | UPPER MISSISSIPPI RIVER | 23 | GROUNDING | $6,570.00 | 2 | RW190 | 1 | STARBOARD BOW |
| Dogtooth | MC94019440 | 11-Sep-94 | 515 | M/V RAY A ECKSTEIN 23 UMR | UPPER MISSISSIPPI RIVER | 23 | GROUNDING | $0.00 | 2 | SG 302 | 3 | PORT BOW |
| Dogtooth | MC93020763 | 15-Nov-93 | 2320 | M/V JOSEPH MERRICK JONES | UPPER MISSISSIPPI RIVER | 23 | GROUNDING | NOT NOTED | 2 | RBL 702B | 1 | PORT BOW |
| Dogtooth | MC93009367 | 28-May-93 | 1820 | M/V HERMAN POTT | UPPER MISSISSIPPI RIVER | 24 | EQUIP FAIL | $30,600.00 | 3 | UBC 196 | 2 | PORT MIDSHIP HALF LENGTH |
| Dogtooth | MC97011949 | 23-Jul-97 | 1540 | M/V BILL ELMER 24 UMR | UPPER MISSISSIPPI RIVER | 24 | GROUNDING | $10,000.00 | 2 | AR 824 | | STARBOARD BOW |
| Dogtooth | MC95017396 | 5-Nov-95 | 1330 | M/V DICK HARBISON 24 UMR | UPPER MISSISSIPPI RIVER | 24 | GROUNDING | $7,500.00 | 4 | MARGE T 210 | | STARBOARD BOW |
| Dogtooth | MC95017396 | 5-Nov-95 | 1330 | M/V DICK HARBISON 24 UMR | UPPER MISSISSIPPI RIVER | 24 | GROUNDING | $7,500.00 | 4 | ABS 1452 | | STARBOARD BOW |
| Dogtooth | MC95017396 | 5-Nov-95 | 1330 | M/V DICK HARBISON 24 UMR | UPPER MISSISSIPPI RIVER | 24 | GROUNDING | $7,500.00 | 4 | DE 8825 | | STARBOARD MIDSHIP HALF LENGTH |
| | MC96017929 | 5-Dec-96 | 1238 | M/V KAY A. ECKSTEIN MI 25 UMR | UPPER MISSISSIPPI RIVER | 25 | GROUNDING | $0.00 | 2 | SG 316 | 6 | STARBOARD BOW |
| | MC94001486 | 24-Jan-94 | 1140 | UMR 25.7 M/V FLOYD H. BLASKE | UPPER MISSISSIPPI RIVER | 25 | GROUNDING | $0.00 | 5 | ACBL 2821 | | STARBOARD MIDSHIP HALF LENGTH |
| | MC94001486 | 24-Jan-94 | 1140 | UMR 25.7 M/V FLOYD H. BLASKE | UPPER MISSISSIPPI RIVER | 25 | GROUNDING | $0.00 | 5 | ML 713 B | | STARBOARD MIDSHIP HALF LENGTH |
| | MC94001486 | 24-Jan-94 | 1140 | UMR 25.7 M/V FLOYD H. BLASKE | UPPER MISSISSIPPI RIVER | 25 | GROUNDING | $0.00 | 5 | ACBL 4121 | | STARBOARD MIDSHIP HALF LENGTH |
| | MC94001486 | 24-Jan-94 | 1140 | UMR 25.7 M/V FLOYD H. BLASKE | UPPER MISSISSIPPI RIVER | 25 | GROUNDING | $0.00 | 5 | ACBL 2842 | | STARBOARD MIDSHIP HALF LENGTH |
| Prices | MC95004640 | 15-Jan-95 | 430 | M/V LAINEY JONES 31 UMR | UPPER MISSISSIPPI RIVER | 31 | GROUNDING | $0.00 | 2 | M/V LAINEY JONES | | PORT QUARTER |
| Prices | MC95004640 | 15-Jan-95 | 430 | M/V LAINEY JONES 31 UMR | UPPER MISSISSIPPI RIVER | 31 | GROUNDING | $0.00 | 2 | ET 453 | | PORT QUARTER |
| | MC94023506 | 11-Nov-94 | 30 | M/V JEFFBOAT 32 UMR | UPPER MISSISSIPPI RIVER | 32 | BREAKAWAY | $4,600.00 | 3 | ACBL 2850 | | STARBOARD QUARTER |
| | MC94023506 | 11-Nov-94 | 30 | M/V JEFFBOAT 32 UMR | UPPER MISSISSIPPI RIVER | 32 | BREAKAWAY | $4,600.00 | 3 | ACBL 3176 | | PORT QUARTER |
| | MC97015552 | 21-Oct-97 | 300 | M/V ARNOLD SOBEL 37 UMR | UPPER MISSISSIPPI RIVER | 37 | GROUNDING | $5,000.00 | 2 | JT 36 | | STARBOARD QUARTER |
| | MC95006828 | 28-Apr-95 | 315 | M/V BUNKER KING 14.8 UMR | UPPER MISSISSIPPI RIVER | 38 | ALLISION | $33,658.00 | 2 | S-27 | 5 | PORT BOW |
| | MC97000170 | 4-Jan-97 | 530 | M/V MIDWEST VOYAGER 39. UMR | UPPER MISSISSIPPI RIVER | 39 | GROUNDING | $11,730.00 | 4 | SER 236 | 1 | STARBOARD BOW |

| Bendway Weirs | Case | Date | Time | Description | Waterway | Mile | Incident Type | Damage | Ves | Vessel Name | Speed | Damage Location |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MC97002685 | 26-Feb-97 | 600 | T/B STCO 226/POTENIAL 39 UMR | UPPER MISSISSIPPI RIVER | 39 | GROUNDING | $2,000.00 | 2 | STCO 226 | | PORT MIDSHIP HALF LENGTH |
| | MC97001478 | 24-Jan-97 | 1040 | M/V NORA PICKETT 41 UMR | UPPER MISSISSIPPI RIVER | 40 | GROUNDING | $0.00 | 2 | COASTAL 2003-L | | STARBOARD BOW |
| | MC96013990 | 12-Sep-96 | 2150 | M/V COOPERATIVE SPIRIT 41 UMR | UPPER MISSISSIPPI RIVER | 41 | GROUNDING | $0.00 | 3 | ART 245B | | PORT QUARTER |
| | MC96013990 | 12-Sep-96 | 2150 | M/V COOPERATIVE SPIRIT 41 UMR | UPPER MISSISSIPPI RIVER | 41 | GROUNDING | $0.00 | 3 | ART 445 | | PORT QUARTER |
| | MC96014848 | 21-Sep-96 | 1845 | M/V ELIZABETH ANN 41 UMR | UPPER MISSISSIPPI RIVER | 41 | GROUNDING | $300.00 | 2 | RCC 100 | | PORT BOW |
| | MC96014845 | 19-Sep-96 | 1355 | M/V BETTY LYNN 41 UMR | UPPER MISSISSIPPI RIVER | 41 | GROUNDING | $0.00 | 1 | BETTY LYNN | | STARBOARD MIDSHIP HALF LENGTH |
| | MC95019539 | 17-Dec-95 | 1800 | M/V DE LASALLE 41 UMR | UPPER MISSISSIPPI RIVER | 41 | GROUNDING | not noted | 4 | OCC 515 | 0 | PORT BOW |
| | MC95019539 | 17-Dec-95 | 1800 | M/V DE LASALLE 41 UMR | UPPER MISSISSIPPI RIVER | 41 | GROUNDING | not noted | 4 | DM 3032 | 0 | STARBOARD BOW |
| | MC96002259 | 13-Feb-96 | 200 | M/V PRAIRIE DAWN 42 UMR | UPPER MISSISSIPPI RIVER | 42 | ALLISION | $30,000.00 | 1 | PRAIRIE DAWN | | STARBOARD QUARTER |
| | MC96018966 | 24-Dec-96 | 515 | M/V ANN BRENT 42 UMR | UPPER MISSISSIPPI RIVER | 42 | GROUNDING | $60,000.00 | 1 | ANN BRENT | | PORT MIDSHIP HALF LENGTH |
| | MC95002759 | 18-Feb-95 | 945 | M/V GENE NEAL 42 UMR | UPPER MISSISSIPPI RIVER | 42 | GROUNDING | $253,500.00 | 12 | AARON G | 2 | NOT NOTED |
| | MC95002759 | 18-Feb-95 | 945 | M/V GENE NEAL 42 UMR | UPPER MISSISSIPPI RIVER | 42 | GROUNDING | $253,500.00 | 12 | WRF 5B | 2 | NOT NOTED |
| | MC95002759 | 18-Feb-95 | 945 | M/V GENE NEAL 42 UMR | UPPER MISSISSIPPI RIVER | 42 | GROUNDING | $253,500.00 | 12 | MM 42 | 0 | PORT QUARTER |
| | MC95002759 | 18-Feb-95 | 945 | M/V GENE NEAL 42 UMR | UPPER MISSISSIPPI RIVER | 42 | GROUNDING | $253,500.00 | 12 | GENE NEAL | 2 | STARBOARD QUARTER |
| | MC95002759 | 18-Feb-95 | 945 | M/V GENE NEAL 42 UMR | UPPER MISSISSIPPI RIVER | 42 | GROUNDING | $253,500.00 | 12 | GENE NEAL | 0 | PORT MIDSHIP HALF LENGTH |
| | MC95002759 | 18-Feb-95 | 945 | M/V GENE NEAL 42 UMR | UPPER MISSISSIPPI RIVER | 42 | GROUNDING | $253,500.00 | 12 | ITC 118 | 2 | PORT MIDSHIP HALF LENGTH |
| | MC95002759 | 18-Feb-95 | 945 | M/V GENE NEAL 42 UMR | UPPER MISSISSIPPI RIVER | 42 | GROUNDING | $253,500.00 | 12 | PV 2918 FL | 2 | PORT MIDSHIP HALF LENGTH |
| | MC95002759 | 18-Feb-95 | 945 | M/V GENE NEAL 42 UMR | UPPER MISSISSIPPI RIVER | 42 | GROUNDING | $253,500.00 | 12 | STFB 36B | 2 | PORT MIDSHIP HALF LENGTH |
| | MC95002759 | 18-Feb-95 | 945 | M/V GENE NEAL 42 UMR | UPPER MISSISSIPPI RIVER | 42 | GROUNDING | $253,500.00 | 12 | DP 273 | 2 | PORT MIDSHIP HALF LENGTH |
| | MC95002759 | 18-Feb-95 | 945 | M/V GENE NEAL 42 UMR | UPPER MISSISSIPPI RIVER | 42 | GROUNDING | $253,500.00 | 12 | F 13 | 2 | PORT MIDSHIP HALF LENGTH |
| | MC95002759 | 18-Feb-95 | 945 | M/V GENE NEAL 42 UMR | UPPER MISSISSIPPI RIVER | 42 | GROUNDING | $253,500.00 | 12 | C G B 209 B | 2 | PORT MIDSHIP HALF LENGTH |
| | MC95002759 | 18-Feb-95 | 945 | M/V GENE NEAL 42 UMR | UPPER MISSISSIPPI RIVER | 42 | GROUNDING | $253,500.00 | 12 | CGB 339 | 2 | PORT MIDSHIP HALF LENGTH |
| | MC95002759 | 18-Feb-95 | 945 | M/V GENE NEAL 42 UMR | UPPER MISSISSIPPI RIVER | 42 | GROUNDING | $253,500.00 | 12 | AGS 933 | 2 | PORT MIDSHIP HALF LENGTH |
| | MC97006597 | 14-May-97 | 600 | M/V BILL ANDREWS 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $99,500.00 | 25 | CC-9210 | | PORT BOW |
| | MC97006597 | 14-May-97 | 600 | M/V BILL ANDREWS 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $99,500.00 | 25 | SUN 406 | | PORT BOW |
| | MC97006597 | 14-May-97 | 600 | M/V BILL ANDREWS 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $99,500.00 | 25 | CGB 250B | | STARBOARD QUARTER |
| | MC97006597 | 14-May-97 | 600 | M/V BILL ANDREWS 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $99,500.00 | 25 | TPC 220 | | PORT BOW |
| | MC97006597 | 14-May-97 | 600 | M/V BILL ANDREWS 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $99,500.00 | 25 | ABC 404 | | PORT QUARTER |
| | MC97006597 | 14-May-97 | 600 | M/V BILL ANDREWS 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $99,500.00 | 25 | ABC 404 | | STARBOARD BOW |
| | MC97006597 | 14-May-97 | 600 | M/V BILL ANDREWS 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $99,500.00 | 25 | CC 95130 | | PORT QUARTER |
| | MC97006597 | 14-May-97 | 600 | M/V BILL ANDREWS 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $99,500.00 | 25 | CC 95135 | | STARBOARD QUARTER |
| | MC95007821 | 14-May-95 | 2030 | M/V AMERICAN PILLAR 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $14,950.00 | 8 | ART 353 | 3 | PORT BOW |
| | MC95007821 | 14-May-95 | 2030 | M/V AMERICAN PILLAR 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $14,950.00 | 8 | ACO 126B | 3 | STARBOARD BOW |
| | MC95007821 | 14-May-95 | 2030 | M/V AMERICAN PILLAR 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $14,950.00 | 8 | AT 520B | 3 | STARBOARD BOW |
| | MC95007821 | 14-May-95 | 2030 | M/V AMERICAN PILLAR 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $14,950.00 | 8 | XL 634B | 3 | STARBOARD BOW |
| | MC95007821 | 14-May-95 | 2030 | M/V AMERICAN PILLAR 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $14,950.00 | 8 | AT 675B | 3 | STARBOARD BOW |
| | MC95007821 | 14-May-95 | 2030 | M/V AMERICAN PILLAR 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $14,950.00 | 8 | ART 490 | 3 | STARBOARD QUARTER |
| | MC95007821 | 14-May-95 | 2030 | M/V AMERICAN PILLAR 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $14,950.00 | 8 | TCB 319 | 3 | STARBOARD QUARTER |
| | MC95008048 | 18-May-95 | 905 | M/V LAINEY JONES 44 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | not noted | 4 | TPC 101 F | 3 | PORT BOW |
| | MC95008048 | 18-May-95 | 905 | M/V LAINEY JONES 44 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | not noted | 4 | LF 521 | 3 | PORT QUARTER |
| | MC95008048 | 18-May-95 | 905 | M/V LAINEY JONES 44 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | not noted | 4 | GOIU 23B | 3 | STARBOARD BOW |
| | MC95011408 | 13-Jul-95 | 500 | M/V GIRARD LEWIS 43.7 UMR | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $98,000.00 | 2 | APEX 102X | 8 | PORT MIDSHIP HALF LENGTH |
| | MC93004002 | 6-Mar-93 | 1410 | ALL: T/B BILL ANDREWS -THEBES | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $111,500.00 | 3 | RBL 517B | | STARBOARD BOW |
| | MC93004002 | 6-Mar-93 | 1410 | ALL: T/B BILL ANDREWS -THEBES | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $111,500.00 | 3 | CJB 290 | | PORT MIDSHIP HALF LENGTH |
| | MC93004011 | 7-Mar-93 | 445 | ALL: M/V LAURA TAMBLE -THEBES | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $132,400.00 | 9 | CGB 462B | | STARBOARD QUARTER |
| | MC93004011 | 7-Mar-93 | 445 | ALL: M/V LAURA TAMBLE -THEBES | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $132,400.00 | 9 | DS 6 | | STARBOARD QUARTER |
| | MC93004011 | 7-Mar-93 | 445 | ALL: M/V LAURA TAMBLE -THEBES | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $132,400.00 | 9 | DS 9 | | PORT BOW |
| | MC93004011 | 7-Mar-93 | 445 | ALL: M/V LAURA TAMBLE -THEBES | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $132,400.00 | 9 | PV 550 FLB | | PORT QUARTER |
| | MC93004011 | 7-Mar-93 | 445 | ALL: M/V LAURA TAMBLE -THEBES | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $132,400.00 | 9 | ABC 423B | | PORT MIDSHIP HALF LENGTH |
| | MC93004011 | 7-Mar-93 | 445 | ALL: M/V LAURA TAMBLE -THEBES | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $132,400.00 | 9 | ML 705B | | PORT BOW |
| | MC93004011 | 7-Mar-93 | 445 | ALL: M/V LAURA TAMBLE -THEBES | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $132,400.00 | 9 | SCF 122 | | STARBOARD BOW |
| | MC93004011 | 7-Mar-93 | 445 | ALL: M/V LAURA TAMBLE -THEBES | UPPER MISSISSIPPI RIVER | 43 | ALLISION | $132,400.00 | 9 | CBL 332 | | PORT BOW |
| | MC94018299 | 1-Sep-94 | 1625 | M/V K.L.J. ERICKSON 43 UMR | UPPER MISSISSIPPI RIVER | 43 | COLLISION | NOT NOTED | 5 | EFC 9228 | 1 | STARBOARD BOW |
| | MC94018299 | 1-Sep-94 | 1625 | M/V K.L.J. ERICKSON 43 UMR | UPPER MISSISSIPPI RIVER | 43 | COLLISION | NOT NOTED | 5 | EFC 9231 | 1 | STARBOARD BOW |
| | MC94018299 | 1-Sep-94 | 1625 | M/V K.L.J. ERICKSON 43 UMR | UPPER MISSISSIPPI RIVER | 43 | COLLISION | NOT NOTED | 5 | OLD YELLOW | 0 | PORT BOW |
| | MC94018299 | 1-Sep-94 | 1625 | M/V K.L.J. ERICKSON 43 UMR | UPPER MISSISSIPPI RIVER | 43 | COLLISION | NOT NOTED | 5 | EFC 9214 | 1 | PORT QUARTER |
| | MC94003472 | 18-Feb-94 | 2015 | M/V BERNARD G 43 UMR | UPPER MISSISSIPPI RIVER | 43 | GROUNDING | $16,000.00 | 2 | CCT 84 | 4 | STARBOARD BOW |
| | MC96015836 | 17-Oct-96 | 340 | M/V J.B. KLEINPETER 45 UMR | UPPER MISSISSIPPI RIVER | 44 | GROUNDING | $1,000.00 | 3 | OR 1055 | | PORT BOW |
| | MC96015836 | 17-Oct-96 | 340 | M/V J.B. KLEINPETER 45 UMR | UPPER MISSISSIPPI RIVER | 44 | GROUNDING | $1,000.00 | 3 | OR 7039 | | PORT QUARTER |
| | MC96018374 | 14-Dec-96 | 230 | M/V MIDWEST VOYAGER 45 UMR | UPPER MISSISSIPPI RIVER | 44 | GROUNDING | $141,962.00 | 4 | OCC 506 | | STARBOARD BOW |
| | MC96018374 | 14-Dec-96 | 230 | M/V MIDWEST VOYAGER 45 UMR | UPPER MISSISSIPPI RIVER | 44 | GROUNDING | $141,962.00 | 4 | CGB 131 | | STARBOARD BOW |
| | MC95003664 | 1-Feb-95 | 1720 | M/V W.A. KERNAN 44 UMR | UPPER MISSISSIPPI RIVER | 44 | GROUNDING | $5,000.00 | 1 | W. A. KERNAN | | STARBOARD QUARTER |

| Bendway Weirs | Case | Date | Time | Description | Waterway | Mile | Incident Type | Damage | Ves | Vessel Name | Speed | Damage Location |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MC95013077 | 13-Aug-95 | 2300 | M/V TRANSPORTER 44 UMR | UPPER MISSISSIPPI RIVER | 44 | GROUNDING | not noted | 2 | TRANSPORTER | 0 | PORT QUARTER |
| | MC95013077 | 13-Aug-95 | 2300 | M/V TRANSPORTER 44 UMR | UPPER MISSISSIPPI RIVER | 44 | GROUNDING | not noted | 2 | H 122 B | 0 | PORT BOW |
| | MC97018083 | 24-Dec-97 | 2330 | M/V BUTCH BARRAS 45 UMR | UPPER MISSISSIPPI RIVER | 45 | GROUNDING | $29,500.00 | 5 | VL 7530 | | PORT BOW |
| | MC97018083 | 24-Dec-97 | 2330 | M/V BUTCH BARRAS 45 UMR | UPPER MISSISSIPPI RIVER | 45 | GROUNDING | $29,500.00 | 5 | VL 7529 | | PORT QUARTER |
| | MC97018083 | 24-Dec-97 | 2330 | M/V BUTCH BARRAS 45 UMR | UPPER MISSISSIPPI RIVER | 45 | GROUNDING | $29,500.00 | 5 | ACBL 2064 | | PORT BOW |
| | MC97018083 | 24-Dec-97 | 2330 | M/V BUTCH BARRAS 45 UMR | UPPER MISSISSIPPI RIVER | 45 | GROUNDING | $29,500.00 | 5 | VLX 7370 | | STARBOARD QUARTER |
| | MC96013987 | 15-Sep-96 | 215 | M/V SHEILA JOHNSON 45 UMR | UPPER MISSISSIPPI RIVER | 45 | GROUNDING | $1,200.00 | 6 | CC 8042 | | PORT BOW |
| | MC96013987 | 15-Sep-96 | 215 | M/V SHEILA JOHNSON 45 UMR | UPPER MISSISSIPPI RIVER | 45 | GROUNDING | $1,200.00 | 6 | B-265 | | PORT BOW |
| | MC96013987 | 15-Sep-96 | 215 | M/V SHEILA JOHNSON 45 UMR | UPPER MISSISSIPPI RIVER | 45 | GROUNDING | $1,200.00 | 6 | CC-9273 | | PORT BOW |
| | MC96013987 | 15-Sep-96 | 215 | M/V SHEILA JOHNSON 45 UMR | UPPER MISSISSIPPI RIVER | 45 | GROUNDING | $1,200.00 | 6 | CC-8051 | | PORT BOW |
| | MC96013987 | 15-Sep-96 | 215 | M/V SHEILA JOHNSON 45 UMR | UPPER MISSISSIPPI RIVER | 45 | GROUNDING | $1,200.00 | 6 | CC 7801 | | PORT BOW |
| | MC94012403 | 2-May-94 | 2200 | M/V BUTCH BARRAS 45 UMR | UPPER MISSISSIPPI RIVER | 45 | GROUNDING | $1,500.00 | 2 | VLB 75109 | 0 | STARBOARD QUARTER |
| | MC95003286 | 27-Feb-95 | 1745 | M/V BERNARD G. 46 UMR | UPPER MISSISSIPPI RIVER | 46 | GROUNDING | $15,000.00 | 2 | NOMA 222 | | PORT BOW |
| | MC95012134 | 31-Jul-95 | 1345 | M/V ROBERT N. STOUT 46 UMR | UPPER MISSISSIPPI RIVER | 46 | GROUNDING | $0.00 | 1 | ROBERT N. STOUT | | STARBOARD MIDSHIP HALF LENGTH |
| | MC95016732 | 23-Oct-95 | 1920 | M/V RAY A. ECKSTEIN 46 UMR | UPPER MISSISSIPPI RIVER | 46 | GROUNDING | $8,000.00 | 1 | RAY A. ECKSTEIN | 1 | STARBOARD MIDSHIP HALF LENGTH |
| | MC95000100 | 5-Dec-94 | 900 | M/V ARNOLD SOBEL 46 UMR | UPPER MISSISSIPPI RIVER | 46 | GROUNDING | $0.00 | 1 | ARNOLD SOBEL | | PORT QUARTER |
| Cape Bend | MC95019534 | 17-Dec-95 | 1230 | M/V ARNOLD SOBEL 48 UMR | UPPER MISSISSIPPI RIVER | 48 | COLLISION | $86,000.00 | 5 | VL 7701 | | STARBOARD BOW |
| Cape Bend | MC95019534 | 17-Dec-95 | 1230 | M/V ARNOLD SOBEL 48 UMR | UPPER MISSISSIPPI RIVER | 48 | COLLISION | $86,000.00 | 5 | SCF 9302B | | PORT MIDSHIP HALF LENGTH |
| Cape Bend | MC95019534 | 17-Dec-95 | 1230 | M/V ARNOLD SOBEL 48 UMR | UPPER MISSISSIPPI RIVER | 48 | COLLISION | $86,000.00 | 5 | CCT 110 | | STARBOARD MIDSHIP HALF LENGTH |
| Cape Bend | MC93021460 | 26-Nov-93 | 1810 | M/V M.PATER/ F.GOODMAN 48 UMR | UPPER MISSISSIPPI RIVER | 48 | COLLISION | $23,000.00 | 5 | PV 2933 FL | | PORT BOW |
| Cape Bend | MC93021460 | 26-Nov-93 | 1810 | M/V M.PATER/ F.GOODMAN 48 UMR | UPPER MISSISSIPPI RIVER | 48 | COLLISION | $23,000.00 | 5 | PV 9924 FL | | PORT BOW |
| Cape Bend | MC93021460 | 26-Nov-93 | 1810 | M/V M.PATER/ F.GOODMAN 48 UMR | UPPER MISSISSIPPI RIVER | 48 | COLLISION | $23,000.00 | 5 | MELINA | | STARBOARD BOW |
| Cape Bend | MC94025506 | 10-Dec-94 | 1230 | M/V KAY A. ECKSTEIN 48 UMR | UPPER MISSISSIPPI RIVER | 48 | GROUNDING | $35,000.00 | 2 | CC7830 | 4 | STARBOARD BOW |
| Cape Bend | MC96011721 | 5-Aug-96 | 725 | M/V LESLIE B (COLLISION) | UPPER MISSISSIPPI RIVER | 50 | COLLISION | $93,000.00 | 6 | MM 53 | 10 | STARBOARD BOW |
| Cape Bend | MC96011721 | 5-Aug-96 | 725 | M/V LESLIE B (COLLISION) | UPPER MISSISSIPPI RIVER | 50 | COLLISION | $93,000.00 | 6 | MM 55 | 10 | STARBOARD QUARTER |
| Cape Bend | MC96011721 | 5-Aug-96 | 725 | M/V LESLIE B (COLLISION) | UPPER MISSISSIPPI RIVER | 50 | COLLISION | $93,000.00 | 6 | CBX 514 | 5 | PORT QUARTER |
| Cape Bend | MC96011721 | 5-Aug-96 | 725 | M/V LESLIE B (COLLISION) | UPPER MISSISSIPPI RIVER | 50 | COLLISION | $93,000.00 | 6 | ET 805B | 5 | STARBOARD BOW |
| Cape Bend | MC96007901 | 28-May-96 | 1915 | M/V GEORGE KING 51 UMR | UPPER MISSISSIPPI RIVER | 50 | GROUNDING | $156,555.00 | 4 | GEORGE KING | | STARBOARD BOW |
| Cape Bend | MC96007901 | 28-May-96 | 1915 | M/V GEORGE KING 51 UMR | UPPER MISSISSIPPI RIVER | 50 | GROUNDING | $156,555.00 | 4 | M/G R 2 | | STARBOARD BOW |
| Cape Bend | MC96007901 | 28-May-96 | 1915 | M/V GEORGE KING 51 UMR | UPPER MISSISSIPPI RIVER | 50 | GROUNDING | $156,555.00 | 4 | CC-7985 | | STARBOARD BOW |
| Cape Bend | MC96007901 | 28-May-96 | 1915 | M/V GEORGE KING 51 UMR | UPPER MISSISSIPPI RIVER | 50 | GROUNDING | $156,555.00 | 4 | CC8275 | | STARBOARD BOW |
| | MC94008561 | 30-Apr-94 | 130 | M/V JAMES H. CAREY 50 UMR | UPPER MISSISSIPPI RIVER | 50 | GROUNDING | $25,000.00 | 2 | PL 151 | 0 | STARBOARD BOW |
| | MC96007367 | 18-May-96 | 515 | M/V BILL O'DONELY 51.6 UMR | UPPER MISSISSIPPI RIVER | 51 | ALLISION | $30,000.00 | 3 | BILL O'DONLEY | | NOT NOTED |
| | MC96007367 | 18-May-96 | 515 | M/V BILL O'DONELY 51.6 UMR | UPPER MISSISSIPPI RIVER | 51 | ALLISION | $30,000.00 | 3 | MCC 902 | | STARBOARD MIDSHIP HALF LENGTH |
| | MC96007367 | 18-May-96 | 515 | M/V BILL O'DONELY 51.6 UMR | UPPER MISSISSIPPI RIVER | 51 | ALLISION | $30,000.00 | 3 | G. L. 144 | | STARBOARD BOW |
| | MC97016296 | 15-Nov-97 | 2150 | M/V CURTIS MOORE 51 UMR | UPPER MISSISSIPPI RIVER | 51 | COLLISION | $18,000.00 | 4 | CURTIS MOORE | | STARBOARD QUARTER |
| | MC97016296 | 15-Nov-97 | 2150 | M/V CURTIS MOORE 51 UMR | UPPER MISSISSIPPI RIVER | 51 | COLLISION | $18,000.00 | 4 | STCO 1001 | | PORT QUARTER |
| | MC97016296 | 15-Nov-97 | 2150 | M/V CURTIS MOORE 51 UMR | UPPER MISSISSIPPI RIVER | 51 | COLLISION | $18,000.00 | 4 | STCO 2303 | | STARBOARD QUARTER |
| | MC93005827 | 1-Apr-93 | 1850 | M/V RAY A. ECKSTEIN | UPPER MISSISSIPPI RIVER | 51 | EQUIP FAIL | $390,000.00 | 7 | RW 261 | 3 | STARBOARD QUARTER |
| | MC93005827 | 1-Apr-93 | 1850 | M/V RAY A. ECKSTEIN | UPPER MISSISSIPPI RIVER | 51 | EQUIP FAIL | $390,000.00 | 7 | RW 261 | 3 | STARBOARD QUARTER |
| | MC93005827 | 1-Apr-93 | 1850 | M/V RAY A. ECKSTEIN | UPPER MISSISSIPPI RIVER | 51 | EQUIP FAIL | $390,000.00 | 7 | JT 38 | 0 | STARBOARD QUARTER |
| | MC93005827 | 1-Apr-93 | 1850 | M/V RAY A. ECKSTEIN | UPPER MISSISSIPPI RIVER | 51 | EQUIP FAIL | $390,000.00 | 7 | JT 38 | 3 | PORT MIDSHIP HALF LENGTH |
| | MC97006107 | 5-May-97 | 2215 | M/V POCONO 51, UMR | UPPER MISSISSIPPI RIVER | 51 | GROUNDING | $10,000.00 | 2 | B-1224 | 0 | STARBOARD MIDSHIP HALF LENGTH |
| Cape Rock | MC97001115 | 20-Jan-97 | 1310 | M/V MIDWEST EXPLORER MI 53 UMR | UPPER MISSISSIPPI RIVER | 53 | GROUNDING | $1,000.00 | 2 | BUNGE 85 | 5 | PORT BOW |
| Cape Rock | MC94016179 | 6-Aug-94 | 745 | M/V TRUCK MORRISON 54 UMR | UPPER MISSISSIPPI RIVER | 53 | GROUNDING | $0.00 | 2 | AGS 504 | 2 | PORT BOW |
| Cape Rock | MC94019521 | 18-Sep-94 | 1700 | M/V WILLIAM MARTIN 53.5 UMR | UPPER MISSISSIPPI RIVER | 53 | GROUNDING | $2,000.00 | 2 | COASTAL 2025-L | 5 | PORT BOW |
| Cape Rock | MC97001472 | 16-Jan-97 | 810 | M/V RICHARD BAKER 54, UMR | UPPER MISSISSIPPI RIVER | 54 | GROUNDING | $0.00 | 2 | ACBL 2016 | 7 | NOT NOTED |
| Cape Rock | MC96000663 | 14-Jan-96 | 1615 | M/V ORLEANIAN 54 UMR | UPPER MISSISSIPPI RIVER | 54 | GROUNDING | $0.00 | 2 | SER 165 | 10 | STARBOARD BOW |
| Cape Rock | MC96002415 | 9-Feb-96 | 730 | M/V ALTONIAN 55.2 UMR | UPPER MISSISSIPPI RIVER | 55 | BREAKAWAY | $75,000.00 | 2 | PV 2947 | | STARBOARD MIDSHIP HALF LENGTH |
| Picayune | MC94010709 | 19-Jan-94 | 1010 | M/V KEVIN TOLEN,GRND,56.9 UMR | UPPER MISSISSIPPI RIVER | 56 | GROUNDING | $0.00 | 4 | BUNGE 67 | | NOT NOTED |
| Picayune | MC94010709 | 19-Jan-94 | 1010 | M/V KEVIN TOLEN,GRND,56.9 UMR | UPPER MISSISSIPPI RIVER | 56 | GROUNDING | $0.00 | 4 | BUNGE 68 | | NOT NOTED |
| Picayune | MC94010709 | 19-Jan-94 | 1010 | M/V KEVIN TOLEN,GRND,56.9 UMR | UPPER MISSISSIPPI RIVER | 56 | GROUNDING | $0.00 | 4 | BUNGE 682 | | NOT NOTED |
| | MC94004986 | 10-Mar-94 | 1105 | UMR 60.0 M/V J. RUSSEL FLOWERS | UPPER MISSISSIPPI RIVER | 60 | EQUIP FAIL | $98,000.00 | 2 | J. RUSSELL FLOWERS | | PORT QUARTER |
| | MC94004986 | 10-Mar-94 | 1105 | UMR 60.0 M/V J. RUSSEL FLOWERS | UPPER MISSISSIPPI RIVER | 60 | EQUIP FAIL | $98,000.00 | 2 | ACBL 3014 | | PORT QUARTER |
| | MC96006165 | 7-Feb-96 | 1300 | NOBLE C. PARSONAGE (SLMMS) | UPPER MISSISSIPPI RIVER | 60 | GROUNDING | not noted | 1 | NOBLE C. PARSONAGE | | NOT NOTED |
| | MC96001091 | 2-Jan-96 | 1040 | CONTI SUSAN (SLMMS) | UPPER MISSISSIPPI RIVER | 68 | GROUNDING | not noted | 4 | CONTI SUSAN | | STARBOARD BOW |
| | MC97007691 | 1-Jun-97 | 255 | JUDI/69.0UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 69 | GROUNDING | not noted | 1 | JUDI | | NOT NOTED |
| | MC95006648 | 20-Apr-95 | 2300 | M/V SHOW ME STATE | UPPER MISSISSIPPI RIVER | 76 | GROUNDING | $85,000.00 | 5 | SHOW ME STATE | | NOT NOTED |
| | MC95006648 | 20-Apr-95 | 2300 | M/V SHOW ME STATE | UPPER MISSISSIPPI RIVER | 76 | GROUNDING | $85,000.00 | 5 | CC 9267 | | STARBOARD BOW |
| | MC95006648 | 20-Apr-95 | 2300 | M/V SHOW ME STATE | UPPER MISSISSIPPI RIVER | 76 | GROUNDING | $85,000.00 | 5 | DM 1314 | | STARBOARD BOW |
| | MC95006648 | 20-Apr-95 | 2300 | M/V SHOW ME STATE | UPPER MISSISSIPPI RIVER | 76 | GROUNDING | $85,000.00 | 5 | AGRI 8061 | | STARBOARD BOW |
| | MC95006648 | 20-Apr-95 | 2300 | M/V SHOW ME STATE | UPPER MISSISSIPPI RIVER | 76 | GROUNDING | $85,000.00 | 5 | CC 7801 | | STARBOARD MIDSHIP HALF LENGTH |

| Bendway Weirs | Case | Date | Time | Description | Waterway | Mile | Incident Type | Damage | Vee | Vessel Name | Speed | Damage Location |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MC96017970 | 5-Dec-96 | 516 | KAY A. ECKSTEIN (SLMMS) | UPPER MISSISSIPPI RIVER | 77 | COLLISION | not noted | 4 | KAY A. ECKSTEIN | | NOT NOTED |
| | MC97010954 | 20-Jul-97 | 430 | S/R ST. LOUIS/78UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 78 | ALLISION | not noted | 1 | S/R ST LOUIS | 12 | PORT QUARTER |
| | MC96012251 | 8-Aug-96 | 225 | BILL STEGBAUER/RITA BARTA(STL) | UPPER MISSISSIPPI RIVER | 80 | COLLISION | not noted | 3 | HMS 290 | | STARBOARD QUARTER |
| | MC96012251 | 8-Aug-96 | 225 | BILL STEGBAUER/RITA BARTA(STL) | UPPER MISSISSIPPI RIVER | 80 | COLLISION | not noted | 3 | RITA BARTA | | PORT QUARTER |
| Fountain Bluff | MC96001835 | 23-Jan-96 | 635 | MIDWEST EXPLORER (SLMMS) | UPPER MISSISSIPPI RIVER | 83 | EQUIP FAIL | not noted | 1 | MIDWEST EXPLORER | | NOT NOTED |
| Fountain Bluff | MC95006735 | 20-Apr-95 | 30 | M/V FLOYD GOODMAN | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $747,500.00 | 19 | CB 41 | | PORT BOW |
| Fountain Bluff | MC95006735 | 20-Apr-95 | 30 | M/V FLOYD GOODMAN | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $747,500.00 | 19 | LF 522 | | PORT BOW |
| Fountain Bluff | MC95006735 | 20-Apr-95 | 30 | M/V FLOYD GOODMAN | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $747,500.00 | 19 | LF 101 B | | PORT BOW |
| Fountain Bluff | MC95006735 | 20-Apr-95 | 30 | M/V FLOYD GOODMAN | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $747,500.00 | 19 | CA528 | | PORT BOW |
| Fountain Bluff | MC95006735 | 20-Apr-95 | 30 | M/V FLOYD GOODMAN | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $747,500.00 | 19 | BUNGE 112 | | PORT BOW |
| Fountain Bluff | MC95006735 | 20-Apr-95 | 30 | M/V FLOYD GOODMAN | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $747,500.00 | 19 | CGB 277B | | PORT BOW |
| Fountain Bluff | MC95006735 | 20-Apr-95 | 30 | M/V FLOYD GOODMAN | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $747,500.00 | 19 | SJT 155 | | PORT QUARTER |
| Fountain Bluff | MC95006735 | 20-Apr-95 | 30 | M/V FLOYD GOODMAN | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $747,500.00 | 19 | AGS 431B | | PORT MIDSHIP HALF LENGTH |
| Fountain Bluff | MC95006735 | 20-Apr-95 | 30 | M/V FLOYD GOODMAN | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $747,500.00 | 19 | ABC 313 | | PORT MIDSHIP HALF LENGTH |
| Fountain Bluff | MC95006735 | 20-Apr-95 | 30 | M/V FLOYD GOODMAN | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $747,500.00 | 19 | CGB 212B | | PORT MIDSHIP HALF LENGTH |
| Fountain Bluff | MC95006735 | 20-Apr-95 | 30 | M/V FLOYD GOODMAN | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $747,500.00 | 19 | PV 2940 | | PORT MIDSHIP HALF LENGTH |
| Fountain Bluff | MC95006735 | 20-Apr-95 | 30 | M/V FLOYD GOODMAN | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $747,500.00 | 19 | ABC 755 | | PORT MIDSHIP HALF LENGTH |
| Fountain Bluff | MC95006735 | 20-Apr-95 | 30 | M/V FLOYD GOODMAN | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $747,500.00 | 19 | SJT 160 | | PORT MIDSHIP HALF LENGTH |
| Fountain Bluff | MC95006735 | 20-Apr-95 | 30 | M/V FLOYD GOODMAN | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $747,500.00 | 19 | ABC 417 | | PORT MIDSHIP HALF LENGTH |
| Fountain Bluff | MC95006735 | 20-Apr-95 | 30 | M/V FLOYD GOODMAN | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $747,500.00 | 19 | CA 127B | | STARBOARD MIDSHIP HALF LENGTH |
| Fountain Bluff | MC95009546 | 1-May-95 | 2000 | M/V ROBERT GREENE | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $22,500.00 | 2 | ROBERT GREENE | | NOT NOTED |
| Fountain Bluff | MC95000193 | 10-Dec-94 | 600 | M/V LOUIS H. MEECE | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $10,000.00 | 3 | ACBL 1272 | | PORT BOW |
| Fountain Bluff | MC95000193 | 10-Dec-94 | 600 | M/V LOUIS H. MEECE | UPPER MISSISSIPPI RIVER | 83 | GROUNDING | $10,000.00 | 3 | ACBL 2881 | | PORT BOW |
| Fountain Bluff | MC96018938 | 27-Dec-96 | 346 | INGLE TOLEN-T/B OCC 514(SLMMS) | UPPER MISSISSIPPI RIVER | 84 | GROUNDING | not noted | 2 | INGLE L. TOLEN | 5 | NOT NOTED |
| Red Rock | MC95018656 | 10-Apr-95 | 2050 | CHARLES SOUTHERN | UPPER MISSISSIPPI RIVER | 93 | GROUNDING | $1,000.00 | 2 | PC 2805 | | STARBOARD MIDSHIP HALF LENGTH |
| Red Rock | MC96004488 | 16-Mar-96 | 45 | M/V TRANSPORTER (SLMMS) | UPPER MISSISSIPPI RIVER | 94 | EQUIP FAIL | not noted | 9 | TRANSPORTER | | NOT NOTED |
| Red Rock | MC96004488 | 16-Mar-96 | 45 | M/V TRANSPORTER (SLMMS) | UPPER MISSISSIPPI RIVER | 94 | EQUIP FAIL | not noted | 9 | CC-8120 | | NOT NOTED |
| Red Rock | MC96004488 | 16-Mar-96 | 45 | M/V TRANSPORTER (SLMMS) | UPPER MISSISSIPPI RIVER | 94 | EQUIP FAIL | not noted | 9 | CC9018 | | NOT NOTED |
| Red Rock | MC97001847 | 18-Jan-97 | 2130 | SANDY N/CONTIJUDI/95UMR(SLMMS) | UPPER MISSISSIPPI RIVER | 95 | COLLISION | not noted | 4 | M/V CONTI JUDI | | NOT NOTED |
| Red Rock | MC97001847 | 18-Jan-97 | 2130 | SANDY N/CONTIJUDI/95UMR(SLMMS) | UPPER MISSISSIPPI RIVER | 95 | COLLISION | not noted | 4 | VLB 9174 | | PORT QUARTER |
| Red Rock | MC97001847 | 18-Jan-97 | 2130 | SANDY N/CONTIJUDI/95UMR(SLMMS) | UPPER MISSISSIPPI RIVER | 95 | COLLISION | not noted | 4 | AGS 914 | | PORT QUARTER |
| Red Rock | MC96006604 | 12-Feb-96 | 1130 | M/V LAINEY JONES (SLMMS) | UPPER MISSISSIPPI RIVER | 95 | GROUNDING | not noted | 2 | PJ123 | 5 | NOT NOTED |
| | MC95009072 | 5-Feb-95 | 1345 | M/V J. ANDREW ECKSTEIN | UPPER MISSISSIPPI RIVER | 103 | GROUNDING | not noted | 1 | J ANDREW ECKSTEIN | | STARBOARD MIDSHIP HALF LENGTH |
| | MC93003534 | 28-Feb-93 | 1000 | KEVIN TOLEN, AGRD 108.2 UMR | UPPER MISSISSIPPI RIVER | 108 | GROUNDING | $2,500.00 | 2 | AO 116 | | STARBOARD MIDSHIP HALF LENGTH |
| | MC93003035 | 16-Jan-93 | 300 | ALOIS LUHR, ALLISION 109.5 UMR | UPPER MISSISSIPPI RIVER | 109 | ALLISION | $48,160.00 | 6 | L 971 | | STARBOARD BOW |
| | MC93003035 | 16-Jan-93 | 300 | ALOIS LUHR, ALLISION 109.5 UMR | UPPER MISSISSIPPI RIVER | 109 | ALLISION | $48,160.00 | 6 | L 977 | | STARBOARD BOW |
| | MC93003035 | 16-Jan-93 | 300 | ALOIS LUHR, ALLISION 109.5 UMR | UPPER MISSISSIPPI RIVER | 109 | ALLISION | $48,160.00 | 6 | L-1001 | | STARBOARD BOW |
| | MC93003035 | 16-Jan-93 | 300 | ALOIS LUHR, ALLISION 109.5 UMR | UPPER MISSISSIPPI RIVER | 109 | ALLISION | $48,160.00 | 6 | GD 905 | | PORT BOW |
| | MC93003035 | 16-Jan-93 | 300 | ALOIS LUHR, ALLISION 109.5 UMR | UPPER MISSISSIPPI RIVER | 109 | ALLISION | $48,160.00 | 6 | 1169 | | PORT QUARTER |
| | MC96017884 | 5-Dec-96 | 1635 | KEVIN TOLEN (SLMMS) | UPPER MISSISSIPPI RIVER | 109 | COLLISION | not noted | 5 | A F 13 | | PORT QUARTER |
| | MC96017884 | 5-Dec-96 | 1635 | KEVIN TOLEN (SLMMS) | UPPER MISSISSIPPI RIVER | 109 | COLLISION | not noted | 5 | CGB 357 | | STARBOARD BOW |
| | MC94023556 | 15-Sep-94 | 830 | M/V ZEUS | UPPER MISSISSIPPI RIVER | 110 | GROUNDING | NOT NOTED | 2 | STCO 181 B | | PORT BOW |
| Kaskaskia | MC96008212 | 10-Jun-96 | 1235 | RAY A. ECKSTEIN (SLMMS) | UPPER MISSISSIPPI RIVER | 116 | ALLISION | $600,000.00 | 23 | RAY A. ECKSTEIN | | PORT BOW |
| Kaskaskia | MC94010707 | 17-Jan-94 | 1405 | M/V KATHY ELLEN GRND,116.9 UMR | UPPER MISSISSIPPI RIVER | 116 | GROUNDING | $0.00 | 4 | AGS 808 | | NOT NOTED |
| Kaskaskia | MC94010707 | 17-Jan-94 | 1405 | M/V KATHY ELLEN GRND,116.9 UMR | UPPER MISSISSIPPI RIVER | 116 | GROUNDING | $0.00 | 4 | NOMA 310B | | NOT NOTED |
| Kaskaskia | MC94010707 | 17-Jan-94 | 1405 | M/V KATHY ELLEN GRND,116.9 UMR | UPPER MISSISSIPPI RIVER | 116 | GROUNDING | $0.00 | 4 | AGS 676B | | NOT NOTED |
| | MC93000624 | 11-Jan-93 | 1030 | M/V BILL STAPP EQUIP/COL/GRD | UPPER MISSISSIPPI RIVER | 145 | EQUIP FAIL | $24,100.00 | 4 | S-27 | | STARBOARD MIDSHIP HALF LENGTH |
| | MC93000624 | 11-Jan-93 | 1030 | M/V BILL STAPP EQUIP/COL/GRD | UPPER MISSISSIPPI RIVER | 145 | EQUIP FAIL | $24,100.00 | 4 | ACO 132B | | STARBOARD QUARTER |
| | MC94004519 | 16-Jan-94 | 1651 | M/V BILL ELMER GRNDG UMR 145 | UPPER MISSISSIPPI RIVER | 145 | GROUNDING | $0.00 | 3 | ACBL 301 | | PORT QUARTER |
| | MC94004519 | 16-Jan-94 | 1651 | M/V BILL ELMER GRNDG UMR 145 | UPPER MISSISSIPPI RIVER | 145 | GROUNDING | $0.00 | 3 | AR 803 | | PORT BOW |
| | MC95009456 | 2-May-95 | 530 | M/V BOB STITH | UPPER MISSISSIPPI RIVER | 146 | GROUNDING | not noted | 2 | BOB STITH | | NOT NOTED |
| | MC96016677 | 31-Oct-96 | 600 | T/B NO. N.M.S. 1952 (SLMMS) | UPPER MISSISSIPPI RIVER | 152 | BREAKAWAY | not noted | 1 | N.M.S. NO. 1952 | | NOT NOTED |
| Carl Beer | MC96016965 | 4-Nov-96 | 1604 | CLYDESDALE (SLMMS) | UPPER MISSISSIPPI RIVER | 164 | ALLISION | not noted | 2 | CLYDESDALE | 2 | STARBOARD QUARTER |
| | MC95006347 | 21-May-95 | 200 | M/V TRIPPER/JB BRIDGE | UPPER MISSISSIPPI RIVER | 168 | ALLISION | not noted | 5 | RW621B | 15 | NOT NOTED |
| | MC95009528 | 21-May-95 | 200 | M/V TRIPPER & M/V SENATOR SAM | UPPER MISSISSIPPI RIVER | 168 | ALLISION | not noted | 8 | TRIPPER | | PORT BOW |
| | MC95019155 | 2-Dec-95 | 330 | KEVIN TOLEN | UPPER MISSISSIPPI RIVER | 168 | GROUNDING | $5,000.00 | 2 | CHEM 39 | | PORT MIDSHIP HALF LENGTH |
| | MC97005723 | 12-Apr-97 | 540 | HARBOR HUSTLER/170UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 170 | GROUNDING | $12,500.00 | 2 | RCC 100 | | NOT NOTED |
| | MC95012517 | 17-Jul-95 | 510 | M/V PHOEBE MERCER GRD 170 UMR | UPPER MISSISSIPPI RIVER | 170 | GROUNDING | not noted | 1 | PHOEBE MERCER | | STARBOARD BOW |
| | MC93008458 | 14-May-93 | 530 | 80 BARGES ADRIFT, MI 171.5 UMR | UPPER MISSISSIPPI RIVER | 171 | BREAKAWAY | NOT NOTED | 9 | RW 242 | | PORT BOW |
| | MC93008458 | 14-May-93 | 530 | 80 BARGES ADRIFT, MI 171.5 UMR | UPPER MISSISSIPPI RIVER | 171 | BREAKAWAY | NOT NOTED | 9 | RW 251 | | PORT BOW |
| | MC93008458 | 14-May-93 | 530 | 80 BARGES ADRIFT, MI 171.5 UMR | UPPER MISSISSIPPI RIVER | 171 | BREAKAWAY | NOT NOTED | 9 | B-251 | | PORT BOW |
| | MC93008458 | 14-May-93 | 530 | 80 BARGES ADRIFT, MI 171.5 UMR | UPPER MISSISSIPPI RIVER | 171 | BREAKAWAY | NOT NOTED | 9 | B-270 | | PORT QUARTER |

| Bendway Weirs | Case | Date | Time | Description | Waterway | Mile | Incident Type | Damage | Ves | Vessel Name | Speed | Damage Location |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MC93008458 | 14-May-93 | 530 | 80 BARGES ADRIFT, MI 171.5 UMR | UPPER MISSISSIPPI RIVER | 171 | BREAKAWAY | NOT NOTED | 9 | CC-8040 | | STARBOARD BOW |
| | MC93008458 | 14-May-93 | 530 | 80 BARGES ADRIFT, MI 171.5 UMR | UPPER MISSISSIPPI RIVER | 171 | BREAKAWAY | NOT NOTED | 9 | RM 50B | | PORT BOW |
| | MC93008458 | 14-May-93 | 530 | 80 BARGES ADRIFT, MI 171.5 UMR | UPPER MISSISSIPPI RIVER | 171 | BREAKAWAY | NOT NOTED | 9 | CC-9220 | | PORT BOW |
| | MC93008458 | 14-May-93 | 530 | 80 BARGES ADRIFT, MI 171.5 UMR | UPPER MISSISSIPPI RIVER | 171 | BREAKAWAY | NOT NOTED | 9 | CC 8017 | | PORT MIDSHIP HALF LENGTH |
| | MC93008458 | 14-May-93 | 530 | 80 BARGES ADRIFT, MI 171.5 UMR | UPPER MISSISSIPPI RIVER | 171 | BREAKAWAY | NOT NOTED | 9 | CC 8026 | | STARBOARD MIDSHIP HALF LENGTH |
| | MC97013306 | 12-Sep-97 | 440 | KAREN MICHELLE/171UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 171 | EQUIP FAIL | $9,544.00 | 5 | CCT 232 B | | NOT NOTED |
| | MC97013306 | 12-Sep-97 | 440 | KAREN MICHELLE/171UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 171 | EQUIP FAIL | $9,544.00 | 5 | MR. ED | | NOT NOTED |
| | MC97013306 | 12-Sep-97 | 440 | KAREN MICHELLE/171UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 171 | EQUIP FAIL | $9,544.00 | 5 | VICKSBURG | | NOT NOTED |
| | MC97013306 | 12-Sep-97 | 440 | KAREN MICHELLE/171UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 171 | EQUIP FAIL | $9,544.00 | 5 | WARREN D | | NOT NOTED |
| | MC97009919 | 4-Jul-97 | 2248 | P/C DEATH (2) 171.5UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 171 | PERSON CAS | $2,000.00 | 3 | ERC08454J889 | | PORT BOW |
| | MC93000481 | 4-Jan-93 | 2030 | ANDREA LEIGH, COL, MI 172 UMR | UPPER MISSISSIPPI RIVER | 172 | ALLISION | $21,700.00 | 3 | AT 44 | | NOT NOTED |
| | MC93000481 | 4-Jan-93 | 2030 | ANDREA LEIGH, COL, MI 172 UMR | UPPER MISSISSIPPI RIVER | 172 | ALLISION | $21,700.00 | 3 | CC 9208 | | NOT NOTED |
| | MC93004398 | 12-Mar-93 | 2300 | DONALD CARGILL MCMILLIAN 172UM | UPPER MISSISSIPPI RIVER | 172 | ALLISION | $61,000.00 | 7 | HUGH C. BLASKE | | STARBOARD BOW |
| | MC93004398 | 12-Mar-93 | 2300 | DONALD CARGILL MCMILLIAN 172UM | UPPER MISSISSIPPI RIVER | 172 | ALLISION | $61,000.00 | 7 | R. W. NAYE | | STARBOARD MIDSHIP HALF LENGTH |
| | MC93004398 | 12-Mar-93 | 2300 | DONALD CARGILL MCMILLIAN 172UM | UPPER MISSISSIPPI RIVER | 172 | ALLISION | $61,000.00 | 7 | AT 603B | | STARBOARD MIDSHIP HALF LENGTH |
| | MC93004398 | 12-Mar-93 | 2300 | DONALD CARGILL MCMILLIAN 172UM | UPPER MISSISSIPPI RIVER | 172 | ALLISION | $61,000.00 | 7 | TOM FRAZIER | | STARBOARD BOW |
| | MC93004398 | 12-Mar-93 | 2300 | DONALD CARGILL MCMILLIAN 172UM | UPPER MISSISSIPPI RIVER | 172 | ALLISION | $61,000.00 | 7 | ART 505 | | STARBOARD QUARTER |
| | MC93004398 | 12-Mar-93 | 2300 | DONALD CARGILL MCMILLIAN 172UM | UPPER MISSISSIPPI RIVER | 172 | ALLISION | $61,000.00 | 7 | DAVID STEGBAUER | | PORT QUARTER |
| | MC93004400 | 13-Mar-93 | 800 | RANDY ECKSTEIN, ALLI, 172 UMR | UPPER MISSISSIPPI RIVER | 172 | ALLISION | $101,000.00 | 7 | RW 240 | | PORT BOW |
| | MC93004400 | 13-Mar-93 | 800 | RANDY ECKSTEIN, ALLI, 172 UMR | UPPER MISSISSIPPI RIVER | 172 | ALLISION | $101,000.00 | 7 | RANDY ECKSTEIN | | STARBOARD MIDSHIP HALF LENGTH |
| | MC93004400 | 13-Mar-93 | 800 | RANDY ECKSTEIN, ALLI, 172 UMR | UPPER MISSISSIPPI RIVER | 172 | ALLISION | $101,000.00 | 7 | RW 187 | | STARBOARD QUARTER |
| | MC93004400 | 13-Mar-93 | 800 | RANDY ECKSTEIN, ALLI, 172 UMR | UPPER MISSISSIPPI RIVER | 172 | ALLISION | $101,000.00 | 7 | T 3074 | | STARBOARD BOW |
| | MC93004400 | 13-Mar-93 | 800 | RANDY ECKSTEIN, ALLI, 172 UMR | UPPER MISSISSIPPI RIVER | 172 | ALLISION | $101,000.00 | 7 | CC-8054 | | PORT BOW |
| | MC93004400 | 13-Mar-93 | 800 | RANDY ECKSTEIN, ALLI, 172 UMR | UPPER MISSISSIPPI RIVER | 172 | ALLISION | $101,000.00 | 7 | RW 834B | | NOT NOTED |
| | MC93004400 | 13-Mar-93 | 800 | RANDY ECKSTEIN, ALLI, 172 UMR | UPPER MISSISSIPPI RIVER | 172 | ALLISION | $101,000.00 | 7 | CC 7908 | | PORT BOW |
| | MC97001496 | 11-Jan-97 | 1435 | HORNET&MIDWEST LEGEND/172 UMR | UPPER MISSISSIPPI RIVER | 172 | COLLISION | not noted | 2 | HORNET | | STARBOARD QUARTER |
| | MC95019300 | 8-Jul-95 | 2300 | M/V PHOEBE MERCER | UPPER MISSISSIPPI RIVER | 172 | COLLISION | $100.00 | 1 | PHOEBE MERCER | | STARBOARD QUARTER |
| | MC96014587 | 19-Sep-96 | 1535 | PAUL MIDDLETON (SLMMS) | UPPER MISSISSIPPI RIVER | 172 | EQUIP FAIL | not noted | 3 | PAUL MIDDLETON | | NOT NOTED |
| | MC95016303 | 9-Oct-95 | 1115 | SENATOR SAM/INLAND OIL FLEET | UPPER MISSISSIPPI RIVER | 173 | ALLISION | $69,000.00 | 8 | T 3023 | | STARBOARD BOW |
| | MC95016303 | 9-Oct-95 | 1115 | SENATOR SAM/INLAND OIL FLEET | UPPER MISSISSIPPI RIVER | 173 | ALLISION | $69,000.00 | 8 | SENATOR SAM | | STARBOARD BOW |
| | MC95013751 | 14-Apr-95 | 300 | M/V WM C. NORMAN COL 173.6 UMR | UPPER MISSISSIPPI RIVER | 173 | COLLISION | not noted | 1 | WILLIAM C. NORMAN | | PORT QUARTER |
| Bellerive | MC97002114 | 23-Jan-97 | 1500 | DELMAR JAEGER/174 UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 174 | GROUNDING | not noted | 1 | DELMAR JAEGER | 2 | STARBOARD QUARTER |
| | MC93007510 | 22-Apr-93 | 1800 | BARGE RW 213, BREAKAWAY | UPPER MISSISSIPPI RIVER | 176 | BREAKAWAY | $2,500.00 | 1 | RW 213 | | PORT QUARTER |
| | MC96008959 | 26-May-96 | 245 | NAVIGATOR (SLMMS) | UPPER MISSISSIPPI RIVER | 177 | ALLISION | $30,000.00 | 1 | NAVIGATOR | | PORT BOW |
| | MC97007642 | 5-Jun-97 | 400 | F/B RRS 7944/BARTON ST (SLMMS) | UPPER MISSISSIPPI RIVER | 177 | BREAKAWAY | not noted | 1 | RRS 7944 | | PORT MIDSHIP HALF LENGTH |
| | MC95018006 | 8-Jun-95 | 300 | KATHLEEN PATER (SLMMS) | UPPER MISSISSIPPI RIVER | 177 | COLLISION | not noted | 1 | KATHLEEN PATER | | NOT NOTED |
| | MC97003230 | 1-Mar-97 | 1344 | MARY BURKE/177UMR(SLMMS) | UPPER MISSISSIPPI RIVER | 177 | SINKING | $400,000.00 | 2 | MARY BURKE | | NOT NOTED |
| | MC96007393 | 16-May-96 | 2000 | VALLEY SUNSHINE (SLMMS) | UPPER MISSISSIPPI RIVER | 177 | SINKING | $350,000.00 | 2 | VALLEY SUNSHINE | | STARBOARD MIDSHIP HALF LENGTH |
| | MC96007393 | 16-May-96 | 2000 | VALLEY SUNSHINE (SLMMS) | UPPER MISSISSIPPI RIVER | 177 | SINKING | $350,000.00 | 2 | CB 44 | | STARBOARD BOW |
| | MC96007024 | 12-May-96 | 1743 | EAGLE FLEET BREAKAWAY (SLMMS) | UPPER MISSISSIPPI RIVER | 178 | BREAKAWAY | $65,000.00 | 11 | CCT-28 | | PORT BOW |
| | MC97016031 | 8-Nov-97 | 2100 | MCCANN DEATH/178 UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 178 | PERSON CAS | not noted | 3 | AGS 941 | 0 | NOT NOTED |
| | MC97016031 | 8-Nov-97 | 2100 | MCCANN DEATH/178 UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 178 | PERSON CAS | not noted | 3 | RF 105 | | NOT NOTED |
| | MC97002576 | 22-Feb-97 | 1121 | CLYDESDALE/179.2UMR(SLMMS) | UPPER MISSISSIPPI RIVER | 179 | ALLISION | not noted | 2 | CLYDESDALE | 0 | PORT BOW |
| | MC96006396 | 29-Apr-96 | 1945 | S/V MISSISSIPPI QUEEN (SLMMS) | UPPER MISSISSIPPI RIVER | 179 | ALLISION | not noted | 1 | MISSISSIPPI QUEEN | 10 | PORT MIDSHIP HALF LENGTH |
| | MC97003970 | 6-Mar-97 | 2310 | PEAVEY N. DOCK BKWY/179UMR/SLM | UPPER MISSISSIPPI RIVER | 179 | BREAKAWAY | $30,000.00 | 1 | T13522B | 5 | STARBOARD MIDSHIP HALF LENGTH |
| | MC95005051 | 5-May-94 | 100 | M/V ROBT Y LOVE, ALL M 180 UMR | UPPER MISSISSIPPI RIVER | 180 | ALLISION | NOT NOTED | 4 | ROBERT Y. LOVE | | PORT MIDSHIP HALF LENGTH |
| | MC95005051 | 5-May-94 | 100 | M/V ROBT Y LOVE, ALL M 180 UMR | UPPER MISSISSIPPI RIVER | 180 | ALLISION | NOT NOTED | 4 | MM 7 | | PORT BOW |
| | MC95005051 | 5-May-94 | 100 | M/V ROBT Y LOVE, ALL M 180 UMR | UPPER MISSISSIPPI RIVER | 180 | ALLISION | NOT NOTED | 4 | MM 8 | | PORT MIDSHIP HALF LENGTH |
| | MC93022154 | 29-Sep-93 | 2330 | PAT BREAN ALLISION EADS BRDG | UPPER MISSISSIPPI RIVER | 180 | ALLISION | $32,000.00 | 2 | ACBL 4049 | | NOT NOTED |
| | MC94008835 | 5-May-94 | 100 | ROBERT T.LOVE/EADSBRIDGE180UMR | UPPER MISSISSIPPI RIVER | 180 | POLLUTION | NOT NOTED | 1 | ROBERT Y LOVE | 10 | PORT QUARTER |
| | MC96002316 | 23-Jan-96 | 1430 | F/B HANNABELLE (SLMMS) | UPPER MISSISSIPPI RIVER | 181 | BREAKAWAY | not noted | 1 | HANNABELLE | | PORT BOW |
| | MC96018935 | 25-Dec-96 | 639 | DELMAR JAEGER (SLMMS) | UPPER MISSISSIPPI RIVER | 181 | GROUNDING | not noted | 2 | DELMAR JAEGER | 5 | NOT NOTED |
| | MC98000803 | 24-Dec-97 | 745 | HARBOR HUSTLER/182UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 182 | GROUNDING | not noted | 2 | SC 1903 | 3 | PORT BOW |
| | MC97013727 | 13-Sep-97 | 1000 | KATY P/183UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 183 | ALLISION | $10,000.00 | 5 | CC-7835 | | STARBOARD QUARTER |
| | MC97013727 | 13-Sep-97 | 1000 | KATY P/183UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 183 | ALLISION | $10,000.00 | 5 | RR 202 | | STARBOARD QUARTER |
| | MC97013727 | 13-Sep-97 | 1000 | KATY P/183UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 183 | ALLISION | $10,000.00 | 5 | AR 848 | | STARBOARD BOW |
| | MC95017487 | 4-Nov-95 | 1430 | GREENVILLE/ALL W/MERCHANT BRI | UPPER MISSISSIPPI RIVER | 183 | ALLISION | not noted | 4 | GREENVILLE | | STARBOARD BOW |
| | MC95017724 | 10-Nov-95 | 1045 | M/V PRECURSOR | UPPER MISSISSIPPI RIVER | 183 | ALLISION | $90,600.00 | 7 | COASTAL 2522 | | PORT BOW |
| | MC95017724 | 10-Nov-95 | 1045 | M/V PRECURSOR | UPPER MISSISSIPPI RIVER | 183 | ALLISION | $90,600.00 | 7 | IB 1806 | | PORT MIDSHIP HALF LENGTH |
| | MC95017724 | 10-Nov-95 | 1045 | M/V PRECURSOR | UPPER MISSISSIPPI RIVER | 183 | ALLISION | $90,600.00 | 7 | IB 1805 | | STARBOARD MIDSHIP HALF LENGTH |
| | MC95017996 | 23-Sep-95 | 535 | M/V BILL STAPP | UPPER MISSISSIPPI RIVER | 183 | ALLISION | $35,000.00 | 2 | A-28 | | STARBOARD BOW |
| | MC95018009 | 9-Oct-95 | 1555 | M/V W. T. TOUTANT | UPPER MISSISSIPPI RIVER | 183 | ALLISION | $500.00 | 2 | ACBL 353X | | PORT QUARTER |

| Bendway Weirs | Case | Date | Time | Description | Waterway | Mile | Incident Type | Damage | Ves | Vessel Name | Speed | Damage Location |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MC95020048 | 19-Dec-95 | 930 | MISS JAN (SLMMS) | UPPER MISSISSIPPI RIVER | 183 | ALLISION | $110,000.00 | 2 | MISS JAN | | NOT NOTED |
| | MC94025484 | 7-Dec-94 | 300 | M/V VIRGINIA ELLISON ALLISION | UPPER MISSISSIPPI RIVER | 183 | ALLISION | $25,000.00 | 7 | COASTAL 2022-T | | STARBOARD BOW |
| | MC95018793 | 29-Nov-95 | 30 | M/V TOM MCCONNELL | UPPER MISSISSIPPI RIVER | 183 | GROUNDING | $0.00 | 2 | BUNGE 407 | | STARBOARD BOW |
| | MC95019154 | 9-Nov-95 | 1810 | CAROL ANN PARSONAGE (SLMMS) | UPPER MISSISSIPPI RIVER | 184 | COLLISION | $75,000.00 | 3 | MEM 7934 | 5 | PORT BOW |
| | MC95019154 | 9-Nov-95 | 1810 | CAROL ANN PARSONAGE (SLMMS) | UPPER MISSISSIPPI RIVER | 184 | COLLISION | $75,000.00 | 3 | ACBL 308 | 2 | PORT BOW |
| | MC96001268 | 22-Jan-96 | 1210 | CLYDESDALE (SLMMS) | UPPER MISSISSIPPI RIVER | 184 | GROUNDING | not noted | 2 | CLYDESDALE | | STARBOARD BOW |
| | MC95006484 | 6-Mar-95 | 1800 | M/V KANSAS CITY | UPPER MISSISSIPPI RIVER | 184 | GROUNDING | not noted | 1 | M/V KANSAS CITY | | STARBOARD BOW |
| | MC93003036 | 14-Feb-93 | 900 | BETSY ROSS, AGRND, MI 184.1 | UPPER MISSISSIPPI RIVER | 184 | GROUNDING | $5,000.00 | 1 | BETSY ROSS | | NOT NOTED |
| | MC97005721 | 16-Apr-97 | 1408 | STARFIRE/185.5UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 185 | ALLISION | $20,000.00 | 2 | ART 385 | | NOT NOTED |
| | MC97010912 | 27-Jun-97 | 2350 | CECILIA CAROL/185.5 UMR(SLMMS) | UPPER MISSISSIPPI RIVER | 185 | ALLISION | $150,000.00 | 2 | CECILIA CAROL | | NOT NOTED |
| | MC95019363 | 18-Apr-95 | 1955 | CITY OF NATCHEZ | UPPER MISSISSIPPI RIVER | 185 | GROUNDING | $1,000.00 | 2 | OMR 2771 | | PORT BOW |
| | MC96016063 | 25-Oct-96 | 1420 | AUSTIN GOLDING (SLMMS) | UPPER MISSISSIPPI RIVER | 190 | EQUIP FAIL | not noted | 2 | AUSTIN GOLDING | | NOT NOTED |
| Mosenthein | MC96016685 | 30-Oct-96 | 1600 | LEVITICUS (SLMMS) | UPPER MISSISSIPPI RIVER | 193 | GROUNDING | not noted | 2 | J & L 6 | | STARBOARD BOW |
| Mosenthein | MC97016018 | 15-Oct-97 | 150 | TOM TALBERT/194.5UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 194 | GROUNDING | not noted | 3 | TOM TALBERT | | NOT NOTED |
| Mosenthein | MC97015649 | 22-Oct-97 | 710 | HARVEST RUN/194UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 194 | GROUNDING | not noted | 2 | HARVEST RUN | | NOT NOTED |
| Mosenthein | MC97017848 | 18-Nov-97 | 345 | KLJ ERICKSON/194.8UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 194 | GROUNDING | $40,000.00 | 2 | K.L.J. ERICKSON | | NOT NOTED |
| Mosenthein | MC97018014 | 18-Nov-97 | 400 | ADMIRAL COCKBURN/194UMR(SLMMS) | UPPER MISSISSIPPI RIVER | 194 | GROUNDING | $2,500.00 | 2 | WTT 857 | | PORT BOW |
| Mosenthein | MC97017083 | 24-Nov-97 | 445 | ELIZABETH LANE/194.2UMR(SLMMS) | UPPER MISSISSIPPI RIVER | 194 | GROUNDING | $31,300.00 | 4 | ELIZABETH LANE | | NOT NOTED |
| Mosenthein | MC96003709 | 11-Mar-96 | 1115 | SEBRING (SLMMS) | UPPER MISSISSIPPI RIVER | 194 | GROUNDING | not noted | 3 | TS-87 | | PORT BOW |
| Mosenthein | MC96016223 | 29-Oct-96 | 1640 | ELIZABETH BEESECKER (SLMMS) | UPPER MISSISSIPPI RIVER | 194 | GROUNDING | not noted | 2 | CC-8118 | 4 | PORT BOW |
| Mosenthein | MC95018764 | 15-Apr-95 | 250 | STARFIRE | UPPER MISSISSIPPI RIVER | 194 | GROUNDING | $2,500.00 | 2 | XL 633B | | PORT QUARTER |
| Mosenthein | MC93022164 | 28-Sep-93 | 315 | COOP VENTURE GROUNDING | UPPER MISSISSIPPI RIVER | 194 | GROUNDING | $0.00 | 2 | XL 344 | | NOT NOTED |
| Mosenthein | MC97017084 | 25-Nov-97 | 300 | HARVEST RUN/195.2UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 195 | ALLISION | $6,000.00 | 2 | HARVEST RUN | | NOT NOTED |
| Mosenthein | MC96001812 | 24-Jan-96 | 647 | KEVIN FLOWERS (SLMMS) | UPPER MISSISSIPPI RIVER | 195 | ALLISION | not noted | 3 | ACBL-2757 | | PORT QUARTER |
| Mosenthein | MC96001812 | 24-Jan-96 | 647 | KEVIN FLOWERS (SLMMS) | UPPER MISSISSIPPI RIVER | 195 | ALLISION | not noted | 3 | ACBL-4150 | | NOT NOTED |
| Mosenthein | MC97015724 | 10-Oct-97 | 1830 | SHEILA JOHNSON/195UMR (SLMMS) | UPPER MISSISSIPPI RIVER | 195 | GROUNDING | $1,275.00 | 3 | 917 | | STARBOARD MIDSHIP HALF LENGTH |
| Mosenthein | MC96016959 | 21-Oct-96 | 500 | BOB KOCH (SLMMS) | UPPER MISSISSIPPI RIVER | 195 | GROUNDING | not noted | 2 | BOB KOCK | 3 | NOT NOTED |
| | MC95019999 | 19-Nov-95 | 1105 | WILLIAM F. PLETTNER (SLMMS) | UPPER MISSISSIPPI RIVER | 200 | ALLISION | not noted | 4 | WILLIAM F. PLETTNER | | NOT NOTED |
| | MC93022160 | 3-Nov-93 | 1730 | CRIMSON GLORY GROUNDING | UPPER MISSISSIPPI RIVER | 220 | GROUNDING | $0.00 | 5 | ART 164 | | NOT NOTED |
| | MC93022160 | 3-Nov-93 | 1730 | CRIMSON GLORY GROUNDING | UPPER MISSISSIPPI RIVER | 220 | GROUNDING | $0.00 | 5 | SG 624B | | NOT NOTED |
| | MC93022160 | 3-Nov-93 | 1730 | CRIMSON GLORY GROUNDING | UPPER MISSISSIPPI RIVER | 220 | GROUNDING | $0.00 | 5 | SG 665B | | NOT NOTED |
| | MC93022160 | 3-Nov-93 | 1730 | CRIMSON GLORY GROUNDING | UPPER MISSISSIPPI RIVER | 220 | GROUNDING | $0.00 | 5 | SG 554B | | NOT NOTED |

# REPORT DOCUMENTATION PAGE

*Form Approved*
*OMB No. 0704-0188*



| 1. REPORT DATE *(DD-MM-YYYY)* | 2. REPORT TYPE | 3. DATES COVERED *(From - To)* |
|---|---|---|
| October 2002 | Contract report | |

**4. TITLE AND SUBTITLE**

Physical Model Test for Bendway Weir Design Criteria

**5a. CONTRACT NUMBER**
DACW 39-99-P-0443

**5b. GRANT NUMBER**

**5c. PROGRAM ELEMENT NUMBER**

**6. AUTHOR(S)**

Waterway Simulation Technology, Inc.
2791 Burnt House Road, Vicksburg, MS 39180

**5d. PROJECT NUMBER**

**5e. TASK NUMBER**

**5f. WORK UNIT NUMBER**
32256

**7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**

Waterway Simulation Technology, Inc., 2791 Burnt House Rd., Vicksburg, MS 39180

**8. PERFORMING ORGANIZATION REPORT NUMBER**

**9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)**

U.S. Army Corps of Engineers, Washington, DC 20314-1000;
U.S. Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory, 3909 Halls Ferry Rd., Vicksburg, MS 39180-6199

**10. SPONSOR/MONITOR'S ACRONYM(S)**

**11. SPONSOR/MONITOR'S REPORT NUMBER(S)**
ERDC/CHL TR-02-28

**12. DISTRIBUTION / AVAILABILITY STATEMENT**

Approved for public release; distribution is unlimited.

**13. SUPPLEMENTARY NOTES**

**14. ABSTRACT**

A typical bendway will be molded in a semi-fixed bed flume. The number of weirs, their spacing and submergence will be varied to determine the effects on tows navigating the reach. The designs will be subjected to a range of current velocities and tow sizes. Final guidance will establish minimum required depths over the weirs and recommended spacing relative to the design size tow.

**15. SUBJECT TERMS**

| | | |
|---|---|---|
| Bathymetry | Hydrographic survey | Mississippi River |
| Bendway weirs | Low water reference plane | Submerged weirs |

| 16. SECURITY CLASSIFICATION OF: | | | 17. LIMITATION OF ABSTRACT | 18. NUMBER OF PAGES | 19a. NAME OF RESPONSIBLE PERSON |
|---|---|---|---|---|---|
| a. REPORT | b. ABSTRACT | c. THIS PAGE | | | 19b. TELEPHONE NUMBER *(include area code)* |
| UNCLASSIFIED | UNCLASSIFIED | UNCLASSIFIED | | 53 | |